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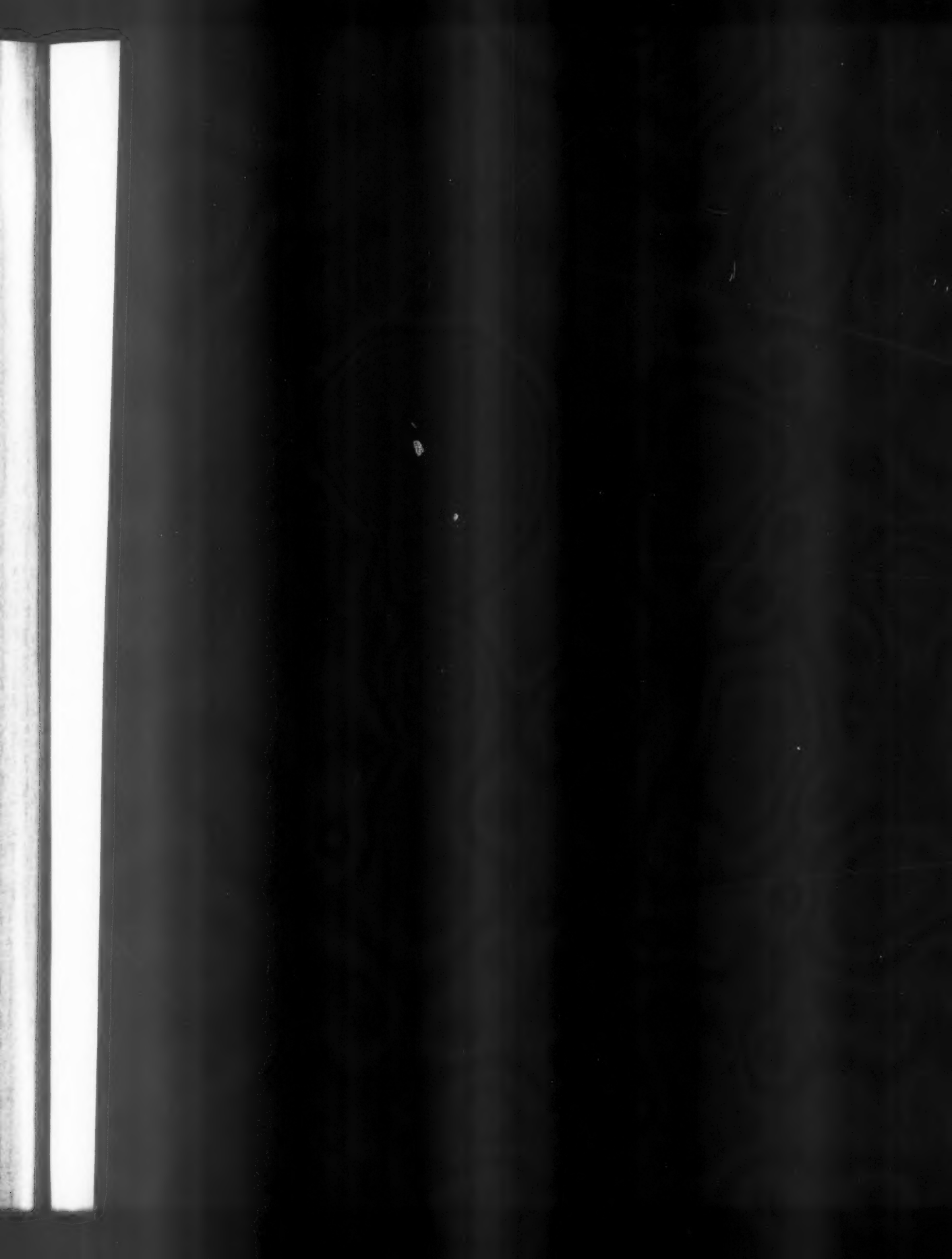
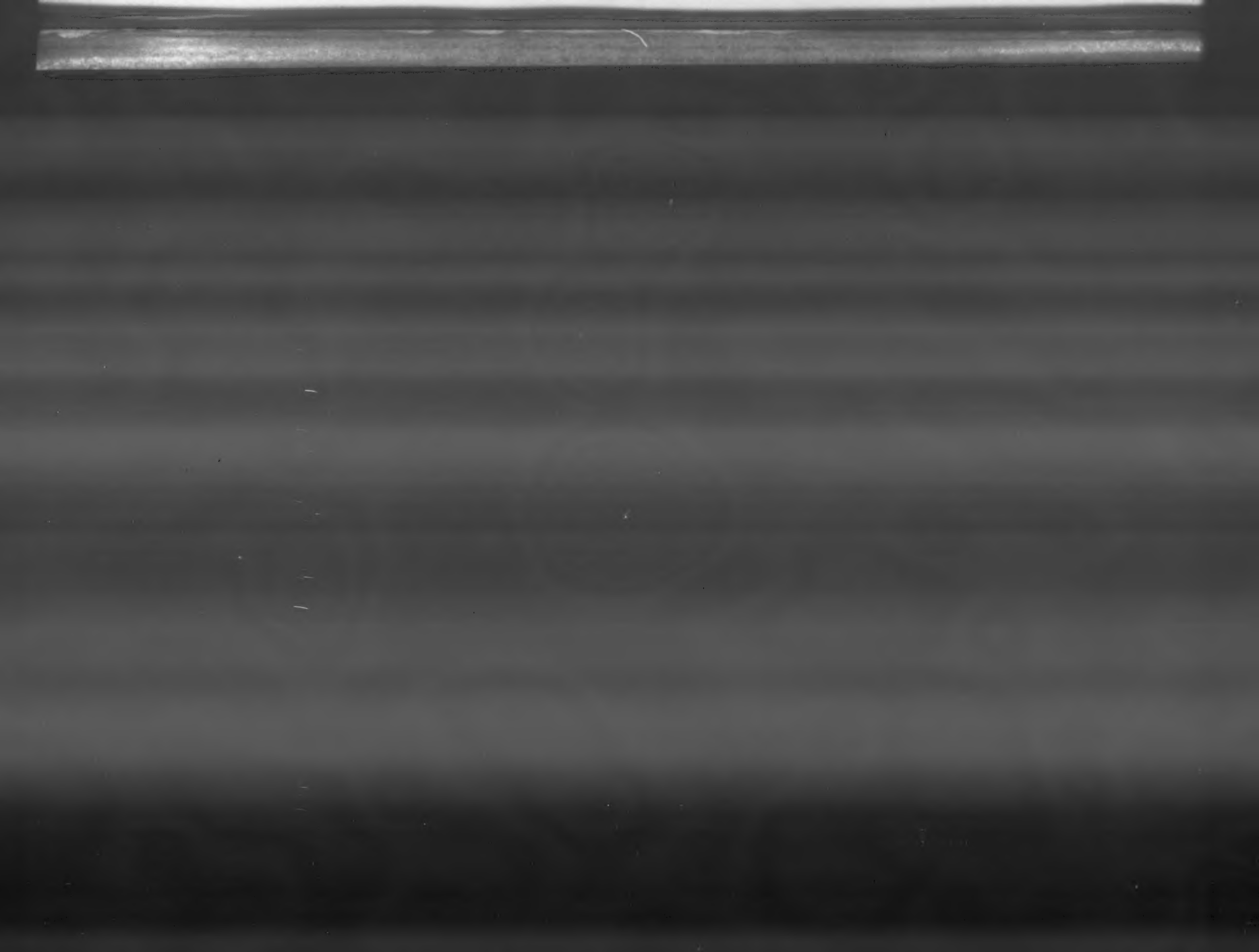




Municipal Engineering

VOLUME XXII. MARCH, NINETEEN HUNDRED TWO. NUMBER 3.

WESTVALE CONCRETE BRIDGE.

By J. R. Worcester, Consulting Engineer, Boston, Mass.

In the spring of 1901 it was decided by the town of Concord, Mass., to replace an old iron highway bridge spanning the Assabet river, in the village of Westvale, with a new structure, and bids were secured on two plans, one for a steel bridge with a buckle plate floor paved with asphalt and the other one a concrete-steel arch. It was found that taking into account the cost of the paving of the steel bridge and also of the abutments, which had to be entirely rebuilt, that the concrete-steel bridge would be cheaper, and it was determined not to consider the steel design further. It was found, however, that there would be a difficulty in procuring immediately the steel ribs in accordance with the design prepared by the engineer, and after considering the cost of the additional concrete required by eliminating the steel ribs altogether, it was determined to build the structure wholly of concrete, and a contract for the work was awarded on May 27th.

The bridge, as built, has a clear span of 66 feet and a width of clear roadway of 35 feet. The arch is elliptical, with a semi-minor axis or rise above the springing line of 11 feet. The springing line is perhaps 2 or 3 feet below the highest water on record, and is about 4 to 6 feet above low water level. The foundations, which are built entirely of concrete, rest upon firm gravel and sand at either end. No sidewalks are provided on the bridge, which carries an electric car track near one curb and an 8-inch water pipe along the opposite side. No iron was used in any part except for the fence railing.

The contractor removed the old bridge and excavated for the east abutment to start concrete work on June 11, 1901. The concrete was made of Phœnix Portland cement and sand and gravel procured in the vicinity of the bridge, in the proportion of 1, 3 and 6. The sand was clean and of good quality. The gravel had a large range of sizes, stones being allowed as large as 4 inches in diameter, and no attempt being made in this part of the work to screen out the fine material. The contractor was allowed to imbed in this abutment concrete stones, such as were found at the site of the bridge, of sizes running up to 1 yard, provided they were kept far enough apart so that the concrete could be carefully rammed around them. The back and sides of the foundation were built against the earth of the excavation, and the front or river side against a form made by laying horizontal planks, backed up with bags of sand. At the time this abutment was put in the river was about 18 inches deep at this point, and was kept out of the excavation by means of the bags of sand. Little or no trouble was experienced from water in the excavation, as it was easily kept in control by means of a small hand pump. When the abutment was built up to the bed of the river forms were carried up to the springing line of the arch, and the skew back itself was rammed under a sloping form. Near the top the size of stones was reduced so that the largest would pass through a 3-inch mesh. Work on this abutment was finished on June 17.

By this time the excavation for the westerly abutment had been nearly completed, and concrete was first laid on this side on June 20, and the abutment was finished on June 24.

The center for the arch was built largely of old materials taken from the former bridge, except the lagging which was made of 2-inch planed spruce plank, matched and put together closely. The posts for the center, which were of plank, rested on

plank sills placed on the bed of the river in the direction of the current, and wedges were used between the tops of the posts and the caps on which the curved ribs were supported. The ribs were braced to the bents of planks bolted to rib and post, dividing the span of ribs into thirds.

It was decided to carry on the work of laying the arch concrete simultaneously from both springing lines, and to work continuously day and night, until the ring was completed. The concrete was laid in approximately horizontal layers, timber dams being used at the termination of a layer, so that the joint would not taper off to a thin edge. The concrete of the arch was mixed in the proportion of 1 part cement, 2 parts sand and 4 parts gravel, in which the largest stone was not to exceed two inches in diameter. Hand mixing only was used, and it was found necessary to mix the concrete rather wetter than would have been the case had the weather been cooler and a greater supply of labor on hand to do the tamping. In general, however, the product appears to have been good. In some places the concrete did not receive the necessary amount of spading against the center so that when the form was removed it showed gravel not properly covered with mortar; and against the vertical faces of the forms there was not sufficient care used to bring a solid mortar joint against the wood. Work was begun on June 28, at 2:30 P. M., and the arch ring was completed at 5 o'clock in the morning of July 1.

When the forms were removed from the faces, it was seen that in a number of places the mortar had failed to fill the joints between the stones, and a ragged appearance was presented. The spandrel walls, which were built up on top of the arch immediately after its completion, were also in some places rather rough after forms were removed. In order to remedy these defects it was decided to cut out pockets in the arch ring and in the walls wherever the work appeared not to be sound and to set in these $\frac{1}{2}$-inch bolts, with their nuts on for anchors, and to fill the pockets around these bolts with concrete. The contractor also, as an additional precaution, wound wires around the bolts and left them to be embedded in the concrete. After the concrete in these pockets had set, the entire face of the spandrel walls and arch ring was dressed to line by stone chisels, and the appearance after dressing is fairly good, though in some cases the material shows different from the rest on account of difference in size of the gravel stones. After the faces were dressed to line, forms were built and the coping put on, the coping being finished on the top and both sides by plaster work in the manner of granolithic sidewalks. As the appearance of this finish was not satisfactory, and in places the plastering had a tendency to split away from the concrete, it was decided to tool the outside face of the copings the same as the walls. The coping was finished on August 7, and on that day the wedges were slacked out under the centering. This

CONCRETE BRIDGE, WESTVALE, MASS.

was done with the idea that if there was any tendency to settle the coping might perhaps accommodate itself to the changed position before being too much set. This was apparently a mistake, as slight cracks appeared across the coping at two places at each end of each wall. It is quite possible, however, that the cracks might have appeared, no matter how long this material had hardened. On August 8 the center was dropped, and the bridge deflected about 7-16 inch on the south side and not any on the north. These deflections were observed 10 days later, and were found to be increased by possibly 1-16 inch each.

After the arch ring was completed, the top surface was covered with a layer of asphalt,which was heated and mopped on in a liquid form; but the whole of the ring was not uncovered for this purpose and consequently no complete view of it could be obtained before it was covered; and while it was thought that all the joints were properly made, it appears from later developments that there must have been parts not covered, as some leakage through the arch has been noted.

After the waterproofing was on, the contractor began at once to fill in over the arch with sand and gravel, and before the centers were struck practically all the filling material was in place and the bridge had been used by teams of all sorts. Within a month after the centering was out, tracks had been laid across for the street railway company, and electrics weighing with their load in the neighborhood of twenty-six tons had crossed the bridge.

The bridge was calculated to sustain a live load of either one hundred pounds per square foot over the entire surface of the bridge or any combination of electric cars weighing twenty tons on two axles or thirty tons on four axles and a steam road-roller weighing fifteen tons. It was so designed that these loads could not produce a strain in the concrete exceeding five hundred pounds per square inch in compression, or fifty pounds per square inch in tension.

The Phœnix cement used in the concrete throughout showed by tests that it was material of very excellent quality and the results obtained in the work fully confirmed what might have been anticipated from the tests.

The bridge was designed for the town of Concord by J. R. Worcester, consulting engineer, 53 State street, Boston, and the contractor for the entire work was Warren Brothers Company, 143 Federal street, Boston.

CHICAGO'S GREAT INTERCEPTING SEWER.

The intercepting sewer system for the south side in Chicago is intended to intercept the sewage from the district now draining into Lake Michigan extending one mile north and six miles south of Thirty-ninth street, on which is located the great conduit which will discharge the sewage into the Chicago river. About 12,000 acres of the city will be sewered into the pump well at the lake end of the Thirty-ninth street conduit. The south intercepting sewer is now under construction. It is wholly below the lake level, is 16 feet in diameter at Thirty-ninth street and 12 feet in diameter at Seventy-third street.

At the pump well will be located centrifugal pumps capable of discharging 300,000 gallons a minute, which will lift the sewage and storm water from the intercepting sewers into the Thirty-ninth street conduit, in which it will flow westward to the river. Two screw pumps will also be installed which can each discharge 300,000 gallons a minute of lake water into the conduit, thus diluting the sewage in the proportion of two to one and making the flow through the conduit 900,000 gallons a minute.

The outlet of the conduit is at the Union Stock Yards slip at Halstead street. The length of the conduit from the outlet to the pump well at the lake is 12,100 feet, about 2¼ miles. The conduit is also wholly below the lake level. About 2,100 feet at the west end was built in a trench with an average cut of 38 feet. This portion is of horseshoe shape, 22 feet horizontal inside diameter and 18.5 feet vertical height. The remainder of the conduit is in tunnel, about 5,500 feet being completed in January, 1902. This section is circular, 20 feet in inside diameter. A shield is used in constructing the sewer, which is a cylindrical steel structure 24 feet 10 inches outside diameter and 12 feet long. It is divided internally into pockets in the face of three horizontal and three vertical partitions, in which the excavation is carried on. The shield is forced ahead by 30 hydraulic jacks, each capable of exerting a pressure of 60 tons. To take this

THIRTY-NINTH STREET INTERCEPTING SEWER, CHICAGO.

pressure, oak timbering 8 inches thick is framed in the rear section of the shield, making a wooden cylinder in which the five rowlock rings of brick are laid in natural cement mortar, completing the construction. The upper part of the excavation for the greater part of the length of tunnel constructed is in quicksand.

The work has been carried on under L. E. McGann, formerly Commissioner of Public Works, F. W. Blocki, present Commissioner, and Wm. S. McHarg, Consulting Engineer. The data for this article were furnished by Mr. McHarg, and the large photograph from which our illustration is reduced was presented by Meacham and Wright, the agents for the Utica natural hydraulic cement, of which 60,000 barrels will be used in the conduit and 110,000 barrels in the entire contract, including the two intercepting sewers.

THE WATER-WORKS SYSTEM OF MIDDLETOWN, N. Y.

The city of Middletown, N. Y., is now constructing considerable additions to its works, which are the result of agitation of the subject extending over a number of years. Some statement of the history of the works, as well as of the present construction, will be of interest to many places in similar situations and will show some of the difficulties arising from having numerous possible sources of supply and the lack of confidence in the reports of experts which is so common among citizens and municipal officials. Doubtless confidence is sometimes misplaced, but it should now be possible to determine beyond a doubt the standing of engineers, and it is not necessary to depend upon those making application for employment.

Monhagen reservoir was constructed in 1867, and the entire construction at that

MONHAGEN RESERVOIR, MIDDLETOWN, N. Y.

date cost about $75,000. Pumps were installed in 1873 at a cost of $60,000 for adding Shawangunk Kill to the supply in the reservoir. This supply was subject to interruption on account of litigation, and was abandoned in 1890, when Highland Lake reservoir was constructed at a cost of $93,000 and supplied the necessary addition of water to Monhagen reservoir by gravity. More water being needed in 1892 some artesian wells were put in at a cost of $8,500, which were a disappointment in the quantity of water furnished, but have often served to carry the city over times of drought.

Since 1893 the present new construction has been under consideration. Four reports by expert engineers have been obtained, all settling upon the same method of obtaining the additional supply, and the matter has been submitted to vote five times. Appropriations of $150,000 were voted down in 1895 and 1896 by decisive majorities, one for $175,000 was carried in 1898, but, when declared illegal for some technicality in advertising, was defeated the next month. In 1900 an appropriation of $190,000 was duly carried, and furnished funds for the construction of a collecting reservoir on Shawangunk Kill, a 24-inch cast-iron conduit 10,000 feet long to new storage Reservoir No. 3, and a 20-inch conduit thence to Monhagen reservoir. Each time this proposition was put to vote there was opposition on account of cost and preference of citizens or officials for other sites. Even after the final plans had been adopted and the question had been prepared for submission to a vote of the people, a special report from the consulting engineer, Mr. William R. Hill, was demanded by some citizens, in order to have in detail his reasons for condemning other propositions. His reasons were so conclusive and the needs of the city were so great that the vote in the week following the report was decisively in favor of the project. The work is now in active progress after some delays for lack of funds.

The plate showing five views gives some idea of the methods adopted in preparing the shores of Monhagen reservoir. The upper corners and the lower left-hand corner show the southeast, south and north shores, the second showing the line of the inlet pipe from Highland reservoir. The lower right-hand corner shows the excavation and riprap of the northerly shore under construction and the center the completed shore protection. General views of Monhagen reservoir and Highland reservoir are shown in other plates.

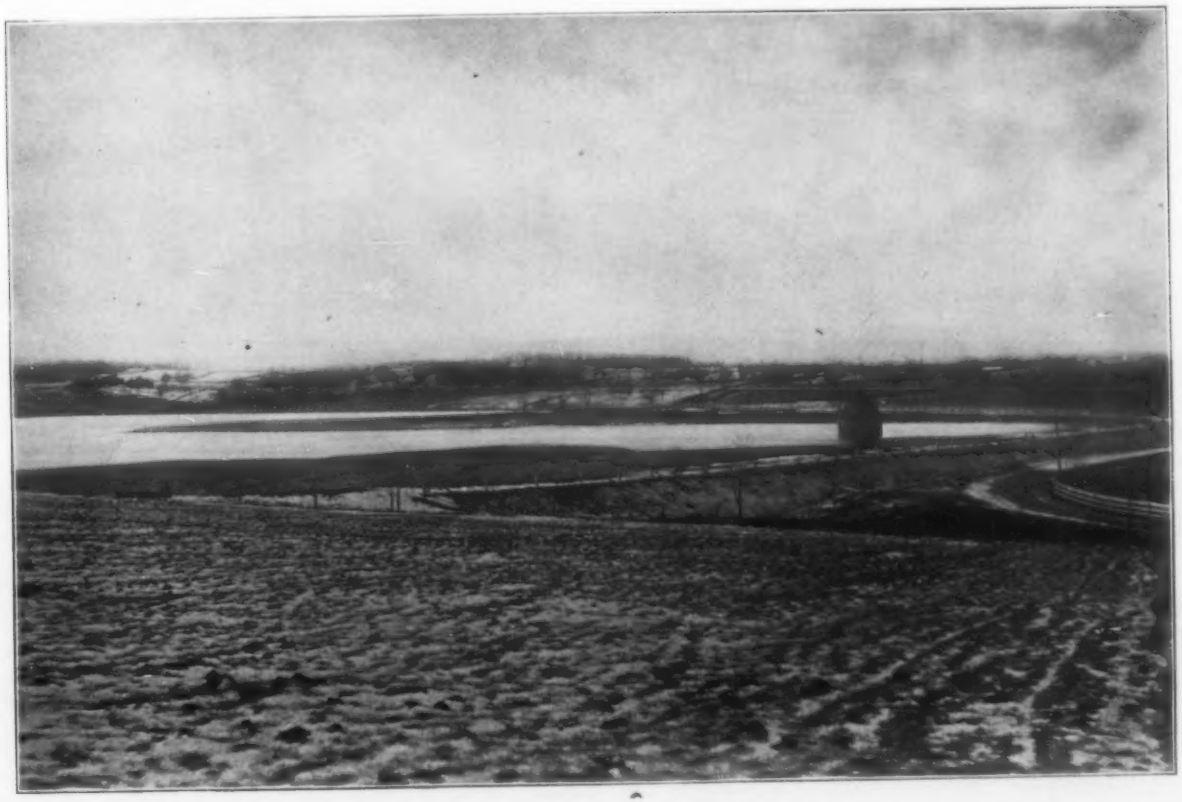
Some years ago complaint of the condition of water from Monhagen reservoir began and in 1899 a mechanical filter plant was begun. It is located near the reservoir and consists of a gravity filter plant of 2,000,000 gallons capacity daily, and a pressure filter plant with capacity of 1,000,000 gallons daily.

The building is shown in one of our illustrations. Under one end is a clear well 73 feet long and 35 feet wide, with a capacity of 9,580 gallons. The building is 128 feet long, 36 feet wide, with walls 10 feet high.

The pressure filter plant consists of 4 steel tanks, 8 feet in diameter and 10 feet long, with the usual number of inlet and outlet valves. Each tank has a manifold of wrought iron pipe with strainer cups, and an internal manifold of brass and galvanized iron pipe for the purpose of distributing the air used in washing the filters. Each filter contains 42 inches of sand. In connection with the pressure system is an aerating device at the high pressure (Highland) reservoir to allow the aeration of the water before entering the pipes passing to filter plant. Highland reservoir water is filtered by this system.

The gravity plant consists of two subsiding basins and four filters, each filter of a capacity of 500,000 gallons daily. The subsiding basins consist of wooden tanks built of 3-inch cypress, each 22 feet in diameter and 7½ feet deep inside. Connected with each tank are the influent and effluent pipes with automatic valves, overflow pipe and sewer drain. The gravity and the pressure filters are shown in one of the accompanying photographs.

The filters consist of four wooden tanks, built of 2½-inch cypress 15 feet in diameter and 7 feet deep. In each filter is a manifold of iron pipes with strainer cups and an internal manifold of brass and galvanized iron pipes for the distribution of air. Each tank contains a layer of sand 36 inches deep. There is supplied with each tank a suitable metal gutter around the periphery of the tank for distributing the applied water and for removing the waste water during washing. Inlet and outlet valves, waste water and air valves are supplied to each tank as are also an automatic inlet regulator and automatic outlet controller. Monhagen reservoir water is filtered by this plant. A 75-horse power boiler, wash-water



MONHAGEN RESERVOIR, MIDDLETOWN, N. Y.

pump, blowing engine and the usual chemical devices, feed pumps, etc., are provided as are also all necessary piping, drains, etc.

The plant has cost about $30,000, and is not yet completed and accepted from the contractors. The estimated cost of maintenance is about $3,300 per year. The total amount of water filtered daily has averaged about 1,500,000 gallons.

ASPHALT PAVING UNDER MUNICIPAL MANAGEMENT.

By F. E. Puffer, Newark, N. J.

Winnipeg is the only city owning and operating an asphalt plant for the purpose of laying new pavements according to the specifications in general use in American cities. St. Louis operates a plant for repairing pavements on which guarantees have expired, using for the purpose a mixture of rock asphalts. Vancouver has a small rock asphalt plant. Minor repairs to asphalt pavements are made by city employes in several cities. Winnipeg, however, successfully operates an asphalt plant and lays new pavements in the regular way.

Three or four years ago, when a demand arose in Winnipeg for pavements, the asphalt paving industry was in a very unsettled condition. In Winnipeg it has been customary for the city to do most of its public work by the day labor system. On looking about, and feeling reasonably sure of supplies of good asphalt, the city decided to built a plant and pave its streets with asphalt under its own management.

A moderate-sized plant almost equal in capacity to the portable asphalt plants in general use at that time was erected, consisting of a single large dryer, a mixer, two melting tanks, and appropriate machinery for supplying power and handling material. This plan has now been in operation three seasons. The first season's work amounted to forty-seven thousand, the second season twenty thousand, and the third season fifty-four thousand yards.

The organization of paving forces includes a gang of men which grades the streets and sets curb, another gang laying concrete base. Supplies are looked after through a general office situated in the city yard where most supplies received from railroads are unloaded. As the city has a large force of foremen and men working for it regularly, an extra gang can always be had when needed. The city operates its own stone quarry; jt gets large supplies of sand from banks that railroads operate chiefly for city use; it purchases cement in large quantities. There is always an abundance of materials.

The asphalt work each season has been under the direction of some experienced asphalt superintendent. A gang of street men, rakers and tampers, is brought from some outside point, and the rest of the work is done by local men. During the last season the asphalt mixture was laid in accordance with formulæ in general use, and records were kept of tests of ingredients and mixture. Samples of sand were screened regularly, and different sands so mixed as to give 26 per cent. (of total pavement mixture) of sand passing an 80-mesh screen and 20 per cent. remaining on a 40-mesh screen. The asphalt cement was tested daily, and records kept according to District of Columbia standards. The penetration of cements used was as follows: California asphalt, 100; Bermudez asphalt, 65; Trinidad asphalt, 50. Samples of paving mixture were tested for bitumen and for dust passing 200-mesh screen. Percentage of bitumen was generally over 10 and dust generally over 11.

Sufficient time has not elapsed since the pavements have been laid to determine their life. However, I am inclined to think that nearly all of them can be maintained for at least ten years at a very reasonable cost. One of the largest streets looks like an unusually good piece of work, and very likely it may last twenty years. Some pavement has been laid that shows defective material and workmanship. This pavement was laid in the absence of a skilled superintendent, and goes to show that a proper asphalt mixture can not be described by a formula that can be followed by inexperienced workmen.

It is generally true that day work is done better than contract work, and asphalt work is likely to be no exception. Competition is so sharp among contractors that they must do the cheapest work they can. The guarantee of a pavement is to a certain extent a safeguard against too cheap construction; but a pavement properly laid should stand longer than the longest term of guarantee ordinarily given. Many pave-

HIGHLAND RESERVOIR, MIDDLETOWN, N. Y.

ments have stood twenty years. It is no secret that since competition has been so close and prices so low, quality of work has often been sacrificed to the necessity of economy. In the case of a city doing its own work there is not the same inducement to sacrifice quality to cost. It is this probability of securing better pavements by day work than by the contract system that forms the chief argument in favor of municipal ownership of asphalt plants.

It might be claimed that a city does not know how to lay a pavement as well as some contractors. The reply is that it can readily engage the services of those who do. There was a time when most of the expert superintendents and men were regularly employed by the large asphalt companies. This condition no longer obtains. Any city may hire as skilled chemists, superintendents and workmen as any connected with asphalt companies. The absorption of small companies by larger ones and changes of ownership and management of large companies have forced out many of the most skilled men, and the services of these men are available by any city that can offer them as lucrative employment as they can secure in other lines of business.

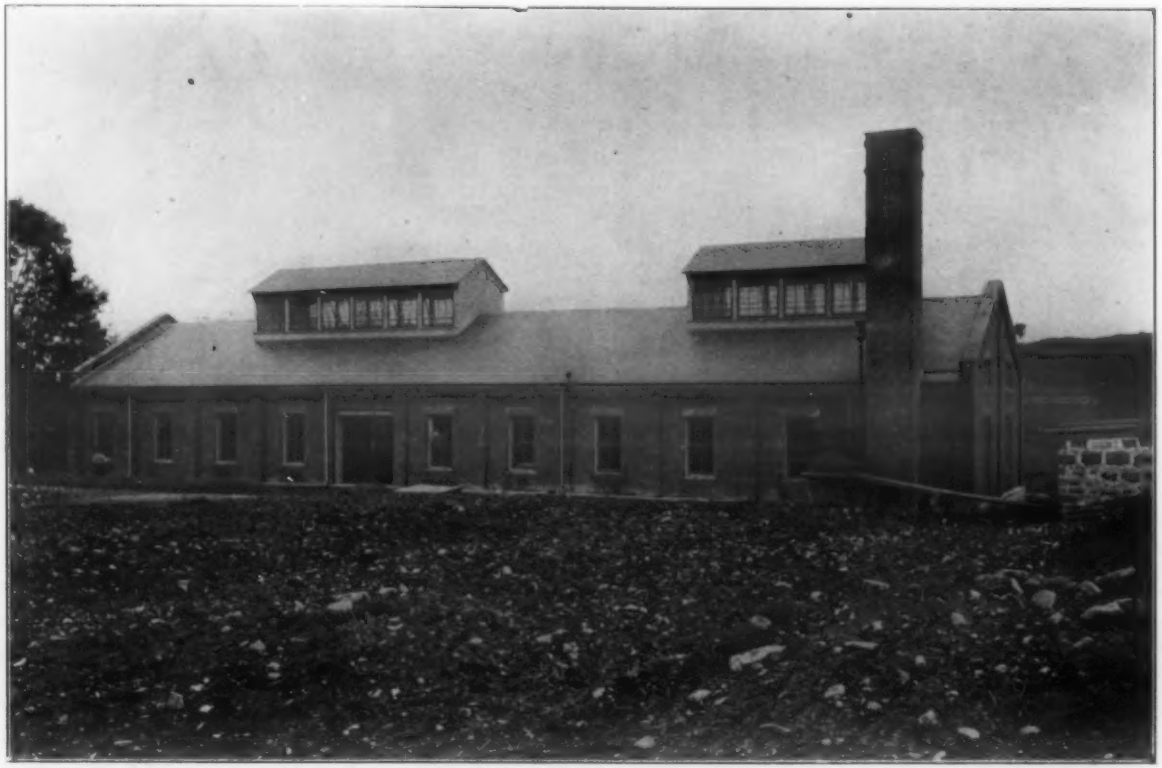
The city of Winnipeg has done work at a lower price than has ever been tendered to it by a contractor. This, however, does not prove very much, as bidding has not been very sharp, the conditions not being such as to invite close competition. However, considering the high prices of labor and material prevailing in Winnipeg, the cost of work has been reasonably low—a little over two dollars per yard. The cost of any work, however, depends very much on what is charged to it, and comparisons of totals where methods of bookkeeping are not known are not as instructive as they might appear. A consideration of the items of cost of work as done by contractor or city is more to the point.

In the matter of labor it is generally believed that day-work is more expensive than contract work, and doubtless it is often true. The cost of work done by a gang of men depends largely on the ability of the foreman.

ASPHALT PAVING FORCE, WINNIPEG, MAN.

It is no uncommon thing to see two foremen working together on the same work for the same pay and one foreman actually worth twenty dollars a day more than the other. The best foremen do not necessarily work for contractors. In Washington, D. C., where a large amount of public work is done by the district government, many of the best foremen in the city work for the district. In fact it is said that any young foreman who shows marked ability in handling men is quite sure to receive an offer of employment from the government. Where records are kept of cost of work and foremen are selected for ability and held up to a high standard of efficiency, there is no reason why a city should not do work at as low or lower labor cost than any contractor.

As to cost of materials, a city doing most



WATER FILTER BUILDING, MIDDLETOWN, N. Y.

of its own work naturally controls the best and cheapest supplies of materials, so that cost of materials used on city work is likely to be lower than cost of materials to a contractor. This is certainly true if the contractor is not well acquainted in the city where he is working. Asphalt pavements are generally laid by men not very familiar with local conditions.

As to cost of asphalt itself, probably some companies produce and refine this material cheaper than it can be bought by a city, but asphalt can be bought at a price considerably below that at which it figures on the books of a branch office of a large company. Winnipeg has always received bids for asphalt at very reasonable prices.

has fixed charges and can no longer bid low. A city can organize a force just suited to do the work it plans to do, and so can keep its fixed charges at a minimum.

Not the least among the fixed charges that a large contracting company has to meet is the cost of idle plants. There is hardly a city in the country that has not plants capable of doing three or four times as much work as is done in that city. Two-thirds or more of the item of maintenance of plants is the cost of superfluous plants. A city should have a plant just sufficient for its work.

Cost of promotion is another item that can not be avoided by a contractor. This is generally a considerable item.

MUNICIPAL ASPHALT PAVING PLANT, WINNIPEG, MAN.

A well-organized force of men, such as was maintained by the old asphalt companies, can do work cheaper than the same quality of work can be done by a green gang of men. However, any city having a large amount of work to do could afford to maintain just as good an organization as a contractor. It only needs a man who knows how to get them together.

In the matter of general charges a city has its chief advantage over a contractor. A new contractor, without an organization and no fixed charges to pay, can underbid any contractor who has fixed annual charges to meet. If the new contractor can get out of doing any work, by selling out or otherwise, so much the better for him, for as soon as he organizes and builds plants he

In the matter of interest a contractor is again at a disadvantage, as a city can borrow money at a lower rate than a contractor. A contractor must pay rent for offices and plant; most cities have land suitable for plants and spaces in their buildings suitable for offices. When a contractor gives a guarantee on a pavement he has to hire an individual or a guarantee company to go surety for him; these people must be paid for their risk, and these charges are a considerable item on long-term guarantees. A city of course would save this item of cost entirely.

In the matter of guarantee repairs to pavements a city is again at an advantage. When the guarantee on a pavement expires a contractor is generally obliged to do more

WATER FILTERS, MIDDLETOWN, N. Y.

work than is really necessary, because the officials in charge fear that while the pavement may look all right, in a few years it may disintegrate rapidly, so to anticipate this they generally order every spot cut up that shows the slightest defect. It is a well-known fact that the standard specification for repairs—requiring depressions of certain depths to be cut up—would condemn large areas of new pavements. The most economical way to keep a pavement in repair is to make the repairs when needed and not before—as any city would do with its own pavements.

When a contractor is laying a pavement the city is put to considerable expense for inspection and supervision to keep quality of work up to standard. If the city does its own work and engages good workmen it needs no other supervision than the daily reports to show that proper amounts of material are being used. The cost of engineering is greater under contract system: the numerous conflicts usual between contractors' men and cities' inspectors take a large part of an engineer's time.

Large contracting companies maintain central offices where the financial part of the business is looked after. Such a company requires the services of expensive managers and accountants. A city doing its own work can do all this at its regular offices, requiring at most an extra clerk or two.

It appears, then, that the peculiarities of Winnipeg asphalt work are general in their nature, and that any city laying asphalt pavements would have about the same results, namely: Cost of labor would be equal or higher than to a contractor; cost of materials less, excepting asphalt, and the item of general charges—amounting, perhaps, to 20 cents per square yard—would be entirely eliminated. The quality of work done by day labor system should be superior to work done by contract. It is difficult to see how a contractor could compete with a municipal paving plant. There do not appear to be any items of cost that a contractor could reduce sufficiently to give him his necessary profit.

EDITORIAL COMMENT.

A Warning. Reports with very substantial basis of fact have reached us, which require some notice to our readers and friends to put them on their guard. They refer to what seem to be studious attempts to produce a confusion of name and location of this magazine with the purpose of taking advantage of this confusion to divert business intended for this magazine. This is a kind of deception which is outside of the realm of legitimate business methods. Subscriptions have been taken from persons who supposed that they were given for this magazine, but they have subsequently discovered that they were receiving, instead of MUNICIPAL ENGINEERING, a New York publication, which recently changed its name to one similar to that of this magazine. In other instances, particularly among advertisers, maliciously false statements have been made. Such methods are their own condemnation and bring their own destruction. It is only necessary to expose them. The success of MUNICIPAL ENGINEERING has been won on its own merits, and it is contrary to our policy to permit our representatives to seek for the magazine anything but consideration of its merits. If any one should be found guilty of resorting to other methods as a representative of this magazine, or of deception for the purpose of securing business, he would be promptly discharged.

To those who read this magazine it is not necessary to say these things, except as a warning to them to take care that their subscriptions are given only to authorized agents of Municipal Engineering Company, or are sent to that company, and to be careful to distinguish clearly between this periodical and the one referred to, whose office is in New York city. Our own central office is in Indianapolis, and we have an office in New York at No. 1 Broadway, not elsewhere on that street or in that city.

Those not familiar with this magazine may be misled by falsehoods and misrepresentations, but we believe we will have the assistance of our readers and friends wherever they have opportunity of preventing this deception.

Municipal Asphalt Plants. There has been considerable discussion in Detroit of the feasibility of constructing a plant for the use of the city in repairing asphalt streets, which could also be used in laying new streets. But one other such plant has been in use in the United States, and it is understood that the use of this plant has

A STREET VIEW, WILMINGTON, DEL.

been discontinued, as stated in a short statement regarding municipal asphalt plants on page 101 of the February number. The opinion of Detroit's Commissioner of Public Works, adverse to the proposed plant for that city, is given in the same article.

We present this month an article on the other side of the subject by an advocate of a municipal plant, who has formed his opinion after experience in operating the Winnipeg plant. Canadian conditions regarding municipal operations are somewhat different from those in the United States. There is more of the English tendency toward municipal ownership and operation of all municipal activities and usually less of the manipulation of official employes and of municipal contracts for labor and supplies for the benefit of politicians, so that Canadian cities have some advantage in the operation of such plants as the Winnipeg asphalt plant.

Even when allowance is made for this difference, there will still remain a number of points in the paper on the Winnipeg plant by Mr. Puffer from which many will differ. Perhaps the principal objection will be that few, except the largest cities, much larger than Winnipeg, have enough new work and repairing to keep an expert asphalt gang in employment, so that they must be paid in idleness, or at least put upon work for which they are not well fitted for a large part of the time. The large asphalt contractor is able to shift his men from place to place as his contracts require. This expense of retaining expert men in the small city or the expense of gathering them together when needed, if it is possible to find them, will offset much of the saving computed in other directions. Even in a city so large as Detroit there may be some extra expense of this sort.

It seems probable that errors in pavement mixtures and construction made by the green hands, which must be employed to some extent, will offset the assumed saving over the cost to the contractor of the guarantee clause, by making more repairs necessary than are made by the contractor under such guarantee. It has not been the writer's experience that unnecessary repairs were required of the contractor at the close of his guarantee period. Unless there is a disposition to grind a contractor for personal reasons, or for political effect, the tendency is strongly toward an equitable adjustment and a reasonable interpretation of the specifications.

The general charges of a company with inflated capital and large cost of promotion are an evident disadvantage, but those of a local contractor are not greater than those of the city, if the computation is properly made. Idle plants are a charge on a company, but so is a plant idle a large part of the year in a small city.

Mr. Puffer gives but few figures to sustain his argument, but City Engineer Ruttan, of Winnipeg, has supplied some regarding the operation of the plant in 1899 and 1900, which appeared in the American Gas Light Journal, and will be found in our department of Current Information. These figures of cost of laying are some cents too low, on account of the neglect of such items as interest and depreciation, but even then they would be materially lower than the contract prices heretofore paid in that city. Even if we add 10 cents to the prices given by Mr. Ruttan, to allow for the neglected items, the revised prices of $2.10 a square yard for 1899 and $2.17 for 1900 compare very favorably with bids of $2.71 and $2.73 made by contractors in 1899, and an offer of $2.47 made after the city had decided to build an asphalt plant.

There are evidently two sides to the question, and it can not be decided rightly for any individual case without unbiased expert examination of all the local conditions.

Cities, large and small, will be interested in the reported success of Syracuse in the use for ordinary repairing of a small portable plant which is taken to the spot where work is to be done. The process was described in an article on "Repairing Asphalt Pavements in Chattanooga," in MUNICIPAL ENGINEERING for March, 1901.

Freight Traffic on Interurban Railways. A paper by W. J. Sherman before the recent convention of the Michigan Society of Engineers gives a general view of some of the problems arising in the development of electric railways which presents several interesting points. The construction of electric railways is now proceeding upon the most promising lines for profitable operation. We will not all agree with Mr. Sherman that all the best lines are now occupied. So long as so well populated a state as Illinois has scarcely a foot of interurban railway not directly connected with Chicago and its suburbs, and but a beginning has been made even in such states as New York, it can not be said that only lines with doubtful prospects are left, especially in view of his statement that lines which he was disposed to report against have developed good paying traffic. The time will soon arrive, however, when the good prospects will all

be taken up, and some of the present good lines are likely to have hard times if a financial depression is inflicted upon us, so that his recommendations that freight business be developed, so that the roads can at least double their business with but little increase in cost beyond new cars and men to run them, are very timely and if heeded will keep many a road out of the hands of the receiver.

The greatest saving in railroad transportation can be made in cost of rehandling. Great saving at the farmer's end can be made in the length of wagon haul. The proposition of a combination wagon, which can be loaded at the farm, hauled a few hundred feet, placed on an electric railway truck and hauled to market, is one which promises saving in both directions, and should be a strong point in favor of the electric line as an economical handler of freight. Even if the combination wagon is not a success, flat cars of special design could be used to transport farm wagons or carts to and from near-by markets and shipping points for long-distance traffic.

Such methods of handling farm products would change the conditions upon which the agitation for good roads depends for much of its ammunition. Rails for transportation to market are far in advance of the best wagon roads, and electricity far ahead of horses. The use of the main roads would be greatly decreased and the cost of maintenance for well constructed roads would be largely decreased, while less expensive roads would be required on lines not yet improved. Such a result as this would be most advantageous to the prairie states where good road materials are scarce. On the other hand, the farmer will need good enough roads to his door to enable him to haul full wagon loads to his railway switch, and, where good materials are convenient, he can improve his own road to suit his own conditions, or at most a small neighborhood will need to combine to construct such neighborhood roads. Where road materials are not to be had, the railway switch can often be extended with light rails at little expense, and either horse or electric traction be used as is most satisfactory on such branches. Several farmers can often join in such branches and the maintenance of their special cars, and by division of time keep cars and wagons busy hauling farm products to market and supplies back to the farm.

There has been no suggestion of bulky freight traffic on an electric road, aside from this unbroken wagon traffic. It is probable that with this exception the restriction of the electric line will be made, for some time at least, to what may be termed package freight. Dairy and poultry products, small shipments of farm products and live stock practically in single packages, going to the city, will be followed in the other direction by family and farm supplies and machinery, which can be delivered at the farmer's door or on a platform at the nearest road crossing. Most of this business will be new business taken from the wagon traffic of the country, and is very likely to aid the railroad freight traffic by increasing the amount of long-haul business. Probably a little short-haul traffic will be cut off, but the loss promises to be less than the gain. Much of the freight traffic of an interurban road can be dignified by the term express matter, and may easily pay more than the standard rates for steam railroad freight. An attempt to classify it strictly as express matter and charge full express rates might easily cut off much of the expected development.

Mr. Sherman says that passenger travel on steam railroads produces only twenty to twenty-five per cent. of the total earnings, and thinks a similar condition could be developed on electric roads, especially as passenger fares on electric roads are only half those on steam roads. If the above reasoning concerning the classification of interurban freight is good, the increase in freight rates is another reason for expecting good comparative results from the new line of business.

Cincinnati Water-Works Funds.

The Board of Trustees, "Commissioners of Water-Works" of Cincinnati, Ohio, finds it necessary to ask for an increase of fifty per cent. in its available funds, and addresses to the members of its county delegation in the state legislature a statement showing the reasons for submitting the two forms for bills which it thinks necessary to give it the proper authority to raise the needed money.

The original act, a copy of which accompanies the communication, provided for issuing $6,500,000 in bonds for the new system and permitting the water board to pay the interest on the bonds issued out of the profits of operation of the old works. Of these bonds $2,850,000 have been issued, and of the money thus raised $1,910,620.93 had been spent on January 27, 1902. Contracts are now let, most of them partly completed, which call for the expenditure of $3,697,825.38 more to complete them, making a bond issue of about $5,600,000 neces-

sary. This leaves only $900,000 more of bonds to be issued. The estimated cost of work yet to be done and not yet contracted for is $3,311,868.20, which is swelled by $739,094.29 for contingencies, general expenses and contingent cost of covering filter basins. This would make the total cost of the works $9,659,408.80.

To meet this, the board asks for authority to increase the bond issue $2,500,000, to apply premiums on bond sales to new construction, and to sell property not longer of use after the new works are well under way and apply the proceeds to paying for new construction. About $130,000 is now on hand as the premium on bonds heretofore sold, and it is estimated that the two items will amount to $750,000, thus making the increase in funds $3,250,000, and the total available $9,750,000.

The increase is accounted for by adding together $950,000, the estimated cost of the high service system, which was not included in the original proposition and estimate, $350,000 for improving the distribution system, which for some unstated reason was also omitted from the original estimate, $100,000 for general expense and engineering on the new items, $125,000 for general expense and engineering on account of two years' delay of the original work by litigation, etc., and $1,625,000 increase in cost over the original estimate, being 25 per cent. of that estimate, on account of increase in prices of labor and material. This last item is said to be necessary because the delay due to the litigation, etc., postponed the letting of contracts until the prices rose in the proportion named.

The new works will supply 66,000,000 gallons a day, and can be enlarged to supply 90,000,000 gallons by the addition of new pumps and filters at a cost of only $485,293.

The interest on bonds issued has been paid out of ordinary water revenues. The original law provided for the beginning of a sinking fund at the end of six years, which have now passed. The communication states that the water revenues can take care of this sinking fund also, and that they can continue to take care of interest and sinking fund for future issues, because payments on these accounts for old issues of bonds will diminish and cease rapidly enough to make room for the new requirements without making allowance for the increased efficiency which is expected from the new works and for the natural growth in water revenues.

It would be difficult to prepare a more clear and definite general statement of the situation than is presented in the communication and it should be a substantial aid in the campaign for the passage of the bills. If any one wishes to go into the details of the matter, the statement will serve as an excellent guide, and all desired information is freely offered. The assumption of the statement is that all previous expenditures have been made properly and as economically as the delays spoken of would permit, and that the same will be true of future expenditures. The books are open for examination upon this point. The board of trustees is certainly composed of competent men who are acting under the technical direction of experts of the highest standing, so that the resulting system of water-works should be a model of engineering construction and application of official executive functions.

Contraction of Wooden Pavements.

No reports of observations of the contraction of wooden pavements from cold seem to have appeared in print, and a statement of some recent observations in Indianapolis may be of interest. During the month of February the average temperature has been below the normal, for the first twenty days being an average constant deficiency of 16 degrees. For much of the time a slight coating of snow has covered the pavements, being renewed by very slight falls about as rapidly as it evaporated or was melted by the direct rays of the sun in open spaces for a short time in the middle of the day. Compacted by travel, the snow was but a fraction of an inch in depth, and undisturbed it probably did not exceed one or two inches in depth at any given time.

The first observation in the early morning after the first night of zero weather of the present "cold spell" showed in a pavement of Washington red cedar (redwood) transverse cracks, extending from curb to curb, usually very nearly on a single joint, the blocks being laid in rows perpendicular to the curb. These cracks appeared quite regularly at intervals of twenty-five to thirty feet, with occasional spaces greater or less. An estimate of the width of cracks indicated about one inch of shrinkage in thirty to thirty-five feet length of pavement, or about 1 in 400. Probably the shrinkage is greater on account of some separation of blocks in the spaces between the large cracks too small to be seen. No longitudinal cracks were observed, but there was an inch or more of undisturbed snow in the gutters which may have concealed them. At noon the temperature of the air was several degrees below

freezing point, but in the sun the snow had softened semewhat. Some reduction in width of cracks was observed.

On a street paved with creosoted yellow pine blocks, laid diagonally, a similar cracking was observed along the long joints. These cracks were much closer together, and consequently narrower, and there was more tendency to scatter, cracks frequently passing from one joint to another, usually in the joint between blocks in a row, but sometimes through a block.

Wagons passing over the pavements produced, when on or near the cracks, a rumbling sound similar to that over a hollow pavement, which changed to the usual sound on wooden pavements midway between the cracks. Observation at the widest cracks showed no arching of the blocks such as would be expected from the rumbling sound.

Later observations under the continued cold weather, varying usually between 0 to 20 at night and 20 to 35 at noon, show corresponding changes in width of cracks, and the development of longitudinal cracks in the gutters of about the same relative dimensions as the transverse cracks. These longitudinal cracks are found in the streets where rows of blocks are perpendicular to the curb, and not where they are on diagonal lines.

Ten days or more after the first cracks were observed, on a night when the temperature was 20 after a day near freezing point, rather loud reports, similar to those heard in expanses of ice, were heard, indicating that the cracks already opened were not sufficient to allow for all the contraction occurring. Increase in the number of cracks from day to day is, in fact, observed. The temperature has seldom been above freezing point long enough at a time to give the blocks water to absorb to counteract the contraction, and the amount of water to be supplied by melting snow has been very slight.

THE QUESTION DEPARTMENT.

BOOKS ON PAVEMENT LAYING.

I would like a book giving details and specifications or method of laying vitrified brick, asphalt, block and macadam pavements.

Chas. Caldwell, City Engineer,
Newburgh, N. Y.

Tillson's "Street Pavements and Paving Materials" ($4) and Byrne's "Highway Construction" ($5) are the standard books upon these subjects. Tillson's book treats more particularly of city pavements and so is probably the better regarding brick and block pavement laying. Byrne's book is devoted more particularly to highways, and its treatment of macadam and related pavements is the most extensive. Each book treats the specialties of the other, however, in considerable detail.

CLEANING SMALL SEWERS.

With reference to the statement on page 94 of the February number under the above heading, to the effect that there is no cure for blockades in sewers from roots except relaying, Mr. Thomas Strouse of Roland Park, Md., states that he has made an appliance for cleaning roots out of 4- and 6-inch sewers on straight or curved lines with very little trouble. He has taken out roots twenty feet long. He says: "About three years ago I had a great deal of trouble with roots in sewers, and thought of relaying the pipe, but now I keep the sewers clear by cleaning twice a year. It takes four men about ten days to go over three miles of 6-inch sewer. Our man-holes are from 400 to 600 feet apart. The sewer should be flushed at least once every 24 hours."

Except in such small systems as the one mentioned, the appliance would have little application except to house connections, for few separate systems of any extent have much pipe less than 8 inches in diameter, and the sizes are still larger in combined systems. Possibly it could be modified for larger sizes of pipe.

ARTICLES ON TAR MACADAM.

In what numbers of MUNICIPAL ENGINEERING will I find articles on the use of coal gas tar in combination with macadam for paving?

G. Blatchford, Pittsfield, Mass.

On page 78, August, 1901, appeared a list of the articles upon tar macadam for pavements which had appeared in MUNICIPAL ENGINEERING previous to that date, eight in number. Specifications for bituminous macadam pavements were given on page 40, July, 1901. An article on "The Development of Bituminous Pavements, Embracing the Use of Coal Tar and Asphalt in Street Work," will be found on page 164, September, 1901, and another on "The Possibilities of the Use of Coal Tar in Bituminous Pavements" on page 285, November, 1901. An article on page 65, February, 1902, describes

some bituminous macadam pavements recently laid in Massachusetts. Two of the articles mentioned are by Mr. Fred J. Warren, who devised the method of construction he describes, and in this number will be found also some selections from a paper by him before the Boston Society of Civil Engineers, giving some technical details not heretofore stated so fully. The full series of articles referred to gives the only complete view of the question of the use of tar for making street pavements which can be found in a single publication, and describes nearly all of the pavements in this country using this material which have been measurably successful.

ASPHALT BLOCKS FOR PAVING PURPOSES.

A municipal asphalt block factory being proposed we would like some information regarding the material and its adaptability to the plan suggested.

H. C., Detroit, Mich.

As stated on page 228 of MUNICIPAL ENGINEERING for October, 1901, the patents on asphalt blocks and machinery for making them are held by the International Asphalt Company of Baltimore, and factories making the blocks operate under arrangement with that company. Undoubtedly a municipal plant must operate under similar conditions. Much information concerning the action of the blocks in use can be obtained from the pages of MUNICIPAL ENGINEERING. Recent articles are those on page 414, December, 1901, on the new asphalt block pavements in Port Huron, Mich., two on page 228, October, 1901, one on page 150, March, 1901, and one on page 158 of the same number describing the asphalt block pavements in Pontiac, Mich. On page 150, March, 1901, will be found a list of earlier articles on the subject. The general conclusion can be drawn from these articles that a good foundation is to be desired for asphalt block pavements as well as for all other pavements; that some of the early asphalt blocks failed on account of the use of soft limestone in them, and that with the harder materials now used, the factories are turning out a very satisfactory paving material. Variations in composition are required by variations in climate, and experience in construction is a large factor in obtaining good results. Cost of plant, cost of proper materials on the ground, royalties, and cost of expert supervision are all items which should be carefully investigated by any municipality proposing to erect and operate its own plant.

MAKERS OF PAVING BRICK.

Will you please give me the addresses of manufacturers of brick suitable for alley paving and for street, alley and sidewalk crossings? Owing to the scarcity of oak lumber we must abandon that material for street and alley crossing purposes, and intend to substitute therefor stone and brick crossings.

A. M. Schmidt, Clerk B. P. W., Fort Wayne, Ind.

In many alleys it is considered safe to use seconds of paving brick, the wear being much lighter than on the street and the appearance not being so great a factor. The character of traffic should be taken into account in deciding to use seconds. For crossings on unpaved streets and alleys a good foundation should be laid and proper crown and approach be given to the walk in the manner frequently suggested in this department for cement concrete crossings. A good quality of brick with reference to appearance should be chosen for this use. On reference to our advertising pages, and to the business directory under the heading of "Paving Brick," will be found the names of a number of makers of suitable brick.

AN EARTH DAM AND STEEL-PIPE OVERFLOW.

It is proposed to use the present street grade across a hollow for a dam and to complete the same by filling the opening through which the brook flows, building a puddle-wall of clay the length of its up-stream side and then filling to safe slopes with convenient dirt. The basin is underlaid with four to six feet of water-bearing sand and gravel between the surface soil and hardpan. The water on the upper side of the dam would be 16 feet deep. It is planned to use for a spillway a steel tube 10 feet in diameter and 85 feet long, curving from the horizontal pipe at the bottom to the desired water level, and to place this pipe in the middle of the dam at the present opening. Would this be good practice? and if so, what thickness of metal should be used in the steel pipe?

Subscriber, ——, Illinois.

This is a problem in engineering design which can be worked out readily by any competent engineer. The sufficiency of foundation and of dam depend upon the materials found in the former and used in the latter. It should not be very difficult to make a good joint about the so-called spillway where it passes through the dam. The size of pipe necessary can also be computed with a reasonable approach to accuracy by an engineer capable of measuring the maximum flow of the stream. These are all very important points, and should not be left to guess work. Any thickness likely to be used in building the pipe, say $\frac{1}{4}$ inch, would be sufficient so far as strength is concerned. The life of a steel pipe in such a place would probably be short, no matter what thickness of reasonable cost is

used, the exposure to atmosphere, shock and wear being too great for protective coatings to withstand.

STATISTICS OF WATER SUPPLY.

What have you published in the way of statistics of water supplies? Is there a book devoted to this subject? What does it cost?

Schmoldt Bros., Beardstown, Ill.

In 1896 and 1897 some tables of statistics of numerous water plants were published in MUNICIPAL ENGINEERING, especially in the numbers for July, 1896, and January, February, April, June, August and October, 1897. There are numerous smaller collections of statistics scattered through all the volumes of this magazine. Baker's "Manual of American Water-Works" ($3), issued in 1897, is devoted to this subject exclusively.

DISTRIBUTION OF COST OF WATER MAINS.

There has been considerable discussion in our city council at various times in reference to proper distribution of cost of water main extensions. Will you kindly inform me what, in your opinion, is the best method and the most equitable manner of paying for water main extensions under municipal ownership, and what system has been adopted by other cities where municipal ownership prevails?

Our water plant was originally owned by a private company, and was purchased by the city in November, 1898. There were about 25 miles of mains at time of purchase. We are desirous of extending the mains this season. The charging of future main extensions to abutting property would work an injustice to property affected, as all property within the city limits is assessed to pay interest and create a sinking fund for redemption of water-works purchasing bonds. A considerable area is not supplied with water, while property in other sections of the city is supplied by mains laid by the original company, which are being paid for as a part of the plant as purchased, no special assessment having been levied on account of said mains. Any information you can furnish will be appreciated. *C. W. Swearingen, City Engineer, Great Falls, Mont.*

The questions raised by this inquiry have been discussed to some extent in connection with methods of making sewer assessments in articles in MUNICIPAL ENGINEERING, on page 215, October, 1898, and 247, April, 1900. An article on the Boston sewer assessment plan, on page 33, July, 1899, will also be of interest.

In case of a change of ownership from private to municipal, it is difficult to make fixed rules which will not work injustice in some special cases. Usually, however, the city is not so thoroughly covered by the system that much inequality between former and future assessments on property for extensions of water mains results. A statement of a few of the principles upon which the assessments should be made may aid in their application and suggest others which should be considered in the special case.

The general benefit to the city up to date has probably been equal to the amount paid for the works, and private property owners have received much benefit without corresponding cost. Probably, however, they have paid for some of these benefits received in the shape of high water rates, the more equitable distribution of cost and the lack of dividends on watered stock often permitting considerable reductions in the rates under municipal ownership. Benefits to the city at large from extensions of the system can be assessed in part by appropriations to pay interest on bonds, to pay for fire protection or to pay part of the cost of laying such extensions, one or all.

Property in front of which water mains are laid is benefited by the presence of the mains in the street, even if no connection is made. This benefit is measured by the frontage, the area, or value of the lot, or some combination of these items. The assessment of the whole or a part of the cost of the pipe line serving the property upon it, according to these measures, will be equitable when the enhancement in the value of the property is considered, the limit of amount of such benefits usually being well above the cost of the pipe.

The use made of the lot may have some consideration in making this assessment, but usually that item is taken care of in the fixing of rates for water used.

Under municipal ownership there is a strong tendency to extend water pipes beyond the actual needs, as a method of enhancing the value of property whose development is desired. Equity requires that this property should pay for the instrument which gives it value. The fact that much city property has paid no water-main assessments can not in general be advanced as a reason for not assessing the cost of such extensions, though there may be a few special cases where the comparison is just.

There has been little scientific study of the questions of assessments and water rates, and many cities pay for all extensions from actual profits of the works or from apparent profits, which ultimately develop a necessity for a bond issue or a direct tax levy. A few cities make some water main assessments. They accept the principle that the property should pay for the size of main needed to serve the street, usually assumed at 6 or 8 inches, and that the city should pay for the extra size needed in supply and main branch lines. Thus Chicago

pays for all pipe lines 12 inches in diameter or more and makes special assessments for the cost of smaller pipe. Detroit assesses cost on abutting property. Milwaukee assesses the cost of a 6-inch pipe on the abutting property and pays any excess due to use of larger size out of the water fund. Minneapolis does the same, fixing the cost of 6-inch pipe at $1.30 a foot. Philadelphia's pumping and large supply mains are paid for by council appropriations from funds raised by general taxation, and service pipes are paid for by local assessments. St. Paul levies a tax of 10 cents a lineal foot on the abutting property annually for ten years, without reference to size of pipe laid. This would seem on the whole to be the proper principle, the exact amounts to be assessed being varied according to local conditions.

BLANKS FOR WATER-WORKS REPORTS.

Please inform me where I can get blanks for water superintendents' annual and general reports.
M. O'Brien, Supt. of Water-Works,
Mechanicsville, N. Y.

In the reports of the meetings of the American Society of Municipal Improvements for 1898 and 1900 will be found some forms for annual reports of water-works which are now under consideration by that society. The same forms are in both volumes and can probably be obtained of the secretary, George W. Tillson, Municipal Building, Brooklyn, N. Y. The forms were also printed in MUNICIPAL ENGINEERING, part of them in November, 1898, and part in January, 1899. The New England Water-Works Association also publishes a blank form for annual statements from water-works, which can be obtained from Charles W. Sherman, 1 Ashburton Place, Boston, Mass. Municipal Engineering Company publishes a set of books for keeping water-works accounts, which is based upon the best practice, and from which annual reports can be taken off with very little labor.

EASTERN MUNICIPAL ELECTRIC LIGHT PLANTS.

Our village has lately appointed a board of light commissioners, and may install a municipal light plant. They have begun an investigation, and I would ask if you can assist them by giving the names of a few municipal plants situated east of Buffalo. *T. Johnson, Supt. Water-Works,*
Canandaigua, N. Y.

The following places east of Buffalo, in New York and Massachusetts, have municipal lighting plants. Other states can be given if desired. The figure following the name of the place gives the population: In New York—Batavia, 9,180; Charlotte, 1,400; Freeport, 2,612; Green Island, 4,770; Groton, 1,344; Hamilton, 1,627; Herkimer, 5,555; Ilion, 5,138; Springville, 1,992; Tully, 574; Watervliet, 14,321. In Massachusetts—Belmont, 2,117; Chicopee, 19,167; Concord, 5,652; Danvers, 4,316; East Braintree, 1,322; Hingham, 1,406; Hudson, 5,308; Marblehead, 7,448; Middleboro, 1,860; Nantasket, 377; North Attleboro, 5,153; Peabody, 9,154; Reading, 4,717; Taunton, 31,036; Wakefield, 7,037; Wellesley, 2,338; Westfield, 10,032.

COST OF CONSTRUCTING AND OPERATING MUNICIPAL ELECTRIC LIGHT PLANTS IN CITIES OF 50,000 POPULATION.

We are anxious to obtain as much information as possible with regard to operating expenses, cost of machinery, cost of installing plant, cost of maintenance, etc., of municipal electric light plants in cities of about 50,000 inhabitants. Kindly give a list of cities averaging about 50,000 inhabitants which operate their own lighting plants and one of those which receive their light from independent companies. *A. M. Schmidt, City Clerk,*
Fort Wayne, Ind.

But one city which has a population between 40,000 and 60,000 is reported as operating a municipal lighting plant. Houston, Texas, has a plant, but also purchases part of the light for the city from a private plant. Cities of the size mentioned having contracts with private companies for furnishing light are Akron, Ohio, Brockton, Mass., Charleston, S. C., Covington, Ky., Dallas, Tex. (two companies), Duluth, Minn., Elizabeth, N. J., Erie, Pa., Harrisburg, Pa., Hoboken, N. J., Lancaster, Pa., Lincoln, Neb., Manchester, N. H., Norfolk, Va., Peoria, Ill., Portland, Me. (two companies), Salt Lake City, Utah, Utica, N. Y., Wilkes Barre, Pa. Other cities of similar size from which we have no reports of municipal plants or of contracts with private plants, should probably be classed with the latter. They are, Evansville, Ind., Kansas City, Kan., Saginaw, Mich., San Antonio, Tex., Savannah, Ga., Waterbury, Conn.

None of these being municipal plants, there are no data regarding cost of construction and operation. Some idea of this cost can be obtained, however, from the 14th annual report of the United States Commissioner of Labor. In this report the plants are classed according to the power of the engines employed. An examination of the reports regarding equipment of the private plants in the cities named above, shows that with but three or four exceptions they are equipped with engines of from 1,000 to 2,500 horse-power. The principal data regarding the municipal plants of these sizes which are found in the commissioner's report are given

in the following table. The first column gives the number of the plant in the report, none of the names of cities being given, the second the horse-power of engines, the third to eighth the details of cost of installing the plant, the ninth to thirteenth the cost of operating it, and the last column the estimated depreciation of the plant, all being for years ending 1897 and 1898.

Plant No.	Horse power of engines.	Land.	Buildings.	Steam plant.	Electric power plant.	Distribution system.	Total cost.
851	1,030	$1,000	$7,000	$45,000	$30,000	$80,000	$163,000
855	1,050	1,000	8,000	40,000	27,000	74,000	150,000
861	.....	12,000	2,000	41,350	38,500	28,356	123,666
867	1,300	25,000	45,000	30,000	30,000	95,000	225,000
891	1,180	1,000	16,000	40,000	20,000	32,048	109,048
894	1,700	34,500	33,792	59,837	60,000	145,490	335,507
906	2,140	63,125	119,309	114,611	71,019	413,619	790,146
914	2,425	45,557	84,524	120,941	54,209	492,180	797,411

	General expenses.	Wages.	Supplies.	Maintenance.	Total annual operating expenses.	Estimated depreciation for 1 year.
851	$8,610	$14,160	$15,198	6,784	44,752	7,890
855	6,586	11,328	12,312	625	30,851	7,210
861	1,733	3,000	1,235	17	5,985	6,077
867	2,700	17,214	13,148	666	33,728	8,650
891	2,523	5,846	4,180	2,263	14,812	4,364
894	6,827	28,997	24,899	12,977	73,700	8,298
906	11,481	44,676	30,847	14,438	101,442	27,552
914	6,463	50,456	40,952	23,319	121,190	.....

Concrete construction has been obliged in this country, so far, to make its way largely on the score of cheapness, and in the effort to reduce the cost sufficient attention has not been paid to the details which affect the appearance of a structure. The construction of forms which will be strong enough to keep exact surfaces and lines is rather expensive, but it is possible without approaching very close to the cost of stone work. The production of artistic work in cement is now so common that its application to the surfaces of bridges is only a matter of detail, and if a little addition is made to the cost it is possible to produce the effect of fine cut stone work at a small fraction of its cost. Such a bridge would cost more than the Meridian street bridge, for example, but would be very much less expensive than a highly ornamented cut stone bridge, such as may be found in parks or in some special location in a large city. The production of fine architectural effects is merely a question of design and careful construction with a reasonable addition to the cost of the roughly constructed concrete arch.

Combined with this objection is the second complaint that the faces of concrete arches crack, and thus produce unsightly surfaces, although the cracks are not dangerous to the stability of the bridge. These, also, are due to defects in designs. A stone arch being in blocks, has many joints to concentrate the movements in the structure due to settlement and to temperature changes, so that the stones themselves are seldom cracked. If a concrete arch is built as a monolith, there are no such joints, and if the changes in form due to settlement or

COMPARISON OF STONE AND CONCRETE ARCH BRIDGES.

Will you give us some statement of the comparative merits of stone and Melan arch bridges?

Hilton U. Brown,
Indianapolis News, Indianapolis, Ind.

The prime advantage which Melan and other concrete arches have over stone is the saving in first cost. This is considerable, as may be seen by comparing the cost of the Illinois and Meridian street bridges in Indianapolis with that of the Central avenue bridge, making due allowance for the differences in conditions. The difference in cost would be still greater if the two Melan arches were all cement, the stone facings adding materially to the expense of construction.

So far as strength is concerned, the Melan construction has the advantage, and the reduction in amount of material necessary is one of the reasons for the less cost.

The objections usually made to concrete arches, whether of solid concrete construction or of such special designs as the Melan, are two. The first is architectural. Under the ordinary methods of construction and of finishing the outside surfaces of concrete work, the appearance of the surface, the uniformity of lines and surfaces, and their conformity to the design are not properly taken care of.

changes in temperature are sufficient, cracks will form. The greater expansion of the surface due to the direct action of the sun upon it, confines these cracks very largely to the surface. This is one of the reasons for putting stone facings on the Meridian street bridge. It is not difficult to design a concrete bridge so that the effect of expansion will be concentrated on points or lines where it can be taken care of without danger of cracking the face of the arch, so that, again, a comparatively slight increase in cost over the common concrete arch will remove the other main objection to their appearance.

UNEQUAL LOADING OF ARCH.

In regard to the Elyria arch and the proposed loading mentioned by a correspondent in your last issue under the above heading, I have, from data published some years ago, the following dimensions for the arch: Span, 150 feet; rise, 24 feet; thickness at crown, 3 feet 9 inches; thickness at skew-back, 4 feet 6 inches; top of roadway above arch at crown, 2 feet. Using these data, and for a rough approximation dividing the span into 10 equal parts of 15 feet each, by the elegant method of Prof. Howe in his book on arches or by the graphic method of Prof. Greene, it can be shown that the arch would undoubtedly be unsafe with the proposed unsymmetrical loading. The arch, however, can be arranged so as to take this unsymmetrical load without danger, by forming voids over the haunches by means of smaller arches and so proportioning the voids and loads as to make the final loading symmetrical. The proper proportion for these loads can be obtained by the well-known graphical method.

I shall be much interested to know whether the dimensions of the arch as given by your correspondent are correct, and especially as to whether the arch really has a rise of only 21 feet.

Yours truly,

F. W. Dalrymple,
City Engineer, Jamestown, N. Y.

MOSAIC WORK.

Will you kindly give me some information on mosaic work, and what is its composition?

Subscriber, ——, Iowa.

There are many kinds of mosaic work from the fine art work with minute pieces of glass, porcelain or stone set in special colorless cement to imitations made with cement mixtures of various colors placed in molds to form variegated surfaces with spots of more or less defined edges. A common form of mosaic tile is made by setting fragments of marble, slate or other stone in cement in molds and subjecting the blocks or tiles to heavy pressure, thus making them very compact. The wearing surface, is about $\frac{1}{2}$-inch in thickness, and the tiles are set in cement, usually upon a concrete base. In the simplest process no attempt is made at patterns or figures of any kind, but many of the patterns and colors of encaustic tile can be reproduced in mosaic tile.

The names of one or two manufacturers of this kind of mosaic work will be found in our advertising columns. Under a strict definition of mosaic work the bits of natural or artificial stone, glass, porcelain or other burnt clay material must be set separately in place. When the pieces become large enough and uniform in size and shape the work becomes simply tile-setting.

CEMENT STEPS.

I find in your "Directory of American Cement Industries and Hand-Book for Cement Users" that one of the many uses for cement is in making steps. I would like to find out a little more about this particular phase of cement work, how they are constructed, and who makes them.

R. L. Brooker, Akron, Ohio.

Any maker of cement walks or other equally high class of cement work can make cement steps. Several methods are in vogue. If but two or three steps are to be laid, perhaps the most satisfactory construction is to make a well drained and thoroughly compacted foundation of earth or selected materials, upon which to lay the concrete for the body of the steps. This concrete may be of the same materials specified in the book mentioned for the lower layer in cement walks. The outer inch in thickness of the steps should be made of a cement mortar made like that for the wearing surface of cement walks. This layer can be made of a consistency to be plastered over the concrete and troweled to the desired form, but better results will be secured if a frame or form is constructed strong enough to permit the ramming of the concrete into place in the manner specified for the construction of cement curb in the book mentioned. The surfaces are finished in the same manner as cement curb. Where earth backing, which is not likely to be disturbed by frost or otherwise, is available a flight of steps of any length can be thus constructed.

In case it is necessary to support the steps on a foundation going below the frost line, or above the surface of the ground, concrete,

brick or rubble stone walls can be built in trenches dug to the necessary depth, and carried above the ground in proper form to give the strength and appearance necessary. In this case the steps can be made in separate blocks in proper molds or forms, and, when ready, may be placed upon the steps formed in the supporting walls by the method used with ordinary stone.

Some form of steel reinforcement can be used if reduction in size or weight of blocks or in cost is desired.

The above information, as well as considerable detail regarding methods of using steel reinforcement for different kinds of cement work, will appear in the new edition of the "Directory of American Cement Industries and Hand-Book for Cement Users" ($5), now in preparation.

FOUNDATIONS FOR CEMENT WALKS.

I have always contended that there are many fallacies which people adhere to simply because these theories have been handed down from their fathers. When I commenced cement work I was told that you must put cinders under walks so that they would not freeze. I also observed that many contractors used just enough to say that cinders were used. I also noticed that, being of a loose nature, they retained more moisture than the surrounding earth, and the consequence was invariably disastrous to the flags. Such being the case, what good results could be obtained by using them? If anything containing moisture comes in contact with cold enough to freeze it will expand, whether it is earth, sand, cinders or macadam. I have never used a shovelful of cinders in all the time I have laid walks, and I find I have as good success or better than those who adhere to cinders. I believe that if you must have anything under your walk you should use clay if you can get it, and I venture to say that such a walk will never give out, unless it is weak in cement. *G. S. Neff, Rochester, N. Y.*

The principle upon which a foundation for a cement walk should be put in is that of proper drainage. The use of cinders is simply to provide a means for reducing the amount of moisture next the walk to a minimum. If the bed of cinders is laid in a trench of clay or other impervious material it serves to collect the water in larger quantities and, if cold enough to freeze, it causes greater disturbance of the walk than would occur if the concrete were laid on the clay soil directly. If the soil is pervious so as to allow the water to soak away rapidly enough, or if proper facilities are provided for drawing off the water reaching the cinders, the bed acts as a drain to lead off the water and give it time to get away before freezing, the small amount of moisture remaining in the particles of cinder not being sufficient to expand the mass under the freezing process. Clay will absorb water, and the effect of freezing upon wet clay is distinctly bad if it is used as a foundation. Clay stiff enough to prevent water from seeping through it is worse than cinders or gravel in a badly drained trench only because it is practically certain to act badly in cold following wet weather, while the trenches will get rid of the water in some way most of the time. When they do fail to remove the water, however, the walk is more seriously injured by the action of the frost. Gravel or broken stone, well rammed, may be used instead of cinders. Thorough drainage of the trench in which the foundation is laid is the first requisite, and if this can not be obtained through the sub-soil, on account of its impervious nature, or on account of the large amount of water reaching the trench, special drains or connections with sewers must be laid to carry the water away fast enough so that it will not be caught by cold weather.

HOLLOW CONCRETE BLOCKS.

Will you inform me where I can get molds to make hollow concrete brick or block for buildings, and at what price? Is there any duty on them and are they patented? Can the brick be made by hand?
R. B. Clement, Walkerton, Ont.

I want you to kindly put me in the way to get the proper machinery and tools for making hollow concrete building blocks, cement tiles and all kinds of ornamental work for buildings.
H. M. Lambert, Moberly, Mo.

The only hollow concrete block of which we have any information at this time is the Palmer Hollow Concrete Block described on page 13 of the January number. These blocks are made in a machine which is run by hand, and the machine is patented. The forms of block made by the machine and the combination of them into a wall are also patented. The machine and molds are doubtless subject to the same duty as other machinery imported into Canada. Details regarding price can be obtained from the general sales agent, W. W. Benson of Terre Haute, Ind.

CRACKS IN CEMENT FLOORS.

Until last year I used sand for the top coat in all my work, but last year I used crushed limestone which passed through a ¼-inch mesh, letting all dust in. All my outside work which was scored did well, but work indoors, such as cellar floors, which I did not score, cracked badly. Would taking out the dust prevent the cracking? What is the cause?
John W. Von Nieda, Ephrata, Pa.

Experiments with limestone dust in cement work indicate a possible increase in strength over mortar made without the dust, so that it is not probable that omitting the dust would prevent the cracking. If there

is too great a proportion of dust, or if the fine material is dirt instead of limestone dust, rapid wear or disintegration of the surface might be expected, but not cracks. The most common causes of cracks, as discussed in detail on page 405, December, 1901, are insufficient foundation with consequent settlement, and insufficient provision for expansion and contraction due to changes in temperature. The cutting of floors into blocks is not always necessary, but sometimes there is sufficient range of temperature to make it desirable. See also page 24, July, 1901; 81, 98 and 99, August, 1901; 230 and 251, October, 1901.

REPAIR OF CEMENT FLOOR.

Please let me know if there is any way to fix a cement floor which was spoiled in laying. I think they used too fine sand for the finishing coat. I am thinking of making the surface rough and then putting on another finish coat. What brand of cement would you advise me to use?

Jos. Ubbink, Port Washington, Wis.

If the floor is subject to slight changes in temperature only, as would probably be the case in a cellar, the method suggested will probably be successful if the new finishing coat is given a thickness of an inch or more and the roughened surface below is perfectly clean. Any dust or small loose particles of the old cement or mortar will prevent proper adhesion of the surfaces. If the surface can be thoroughly washed by a stream from hose under proper pressure, the best result will probably be obtained, and the surface will be wet when the new finishing coat is applied, which should be done as soon as possible, taking care to keep the surface clean and damp until entirely covered. It is probable that a complete junction of the new finishing coat with the old base can not be procured over the entire surface. If there is little change in temperature this will not be serious, but if the top coat has the variations of northern climates from below zero in winter to over 120° in the direct rays of the sun in summer, it is liable to separate from the base and finally crack and break up. In this case the only sure method of keeping the floor down is to take it up and relay it with proper expansion joints and the finishing coat put on before the cement in the base has set, so as to make each block of the floor a monolith.

Is it possible that the fault is in the base or in the foundation rather than in the top coat?

There are now so many good brands of Portland cement that the choice can often be made on the basis of price. The manufacturers represented in our advertising columns make high-grade cement, almost without exception. It is, of course, necessary to use a high grade of Portland cement. Neither natural hydraulic cement, improved natural cement nor puzzolan should be used, even if advertised as Portland cement. The descriptions of works and brands in the "Directory of American Cement Industries and Hand-Book for Cement Users" ($5) will enable one to make the distinctions in brands readily, to select the best brand manufactured by each company and to some extent to form a judgment of the probable relative value of cements of different manufacturers. Direct comparisons of values of cements would, of course, be out of place in a book representing the entire trade.

MARL AND ROCK CEMENTS—CONCRETE MIXER.

I would like to ask you regarding Portland cement made in northern territory for sidewalk purposes. I have used Buckeye and Medusa only, while I am thoroughly acquainted with imported and eastern American Portland cement, such as Vulcanite, Atlas, Alpha, Empire, Saylors, Diamond, Wayland, Reading. How do the cements made in Michigan, Indiana and Illinois compare with the above?

Have you any knowledge of the Dromedary concrete mixer, made in Washington, D. C.?

Chas. Frankenberg, Gallipolis, O.

Roughly speaking, the comparison desired is that between cements made from rock and those made from marl and clay. A discussion of this question will be found on page 229 of MUNICIPAL ENGINEERING for October, 1901, in which the conclusion is reached that the quality of the cement is not a question of the general class of materials used, but rather one of selection of the particular materials to be used for a brand and the care with which they are combined into cement.

From the "Directory of American Cement Industries and Hand-Book for Cement Users" ($5) it is learned that the Empire and Wayland brands of eastern cement are marl cements, and that the Medusa and Buckeye brands are also marl cements, while the others are rock cements. The experience of our correspondent having been with both classes of cement, he is able to judge from their behavior of their relative merits.

From the Directory it is also learned that one of the factories of Medusa cement is in Indiana, and that the other factory now in operation in that state is also making marl cement; that all but two of the Michigan plants are making marl cement, those two using rock treated in the same manner used in many eastern factories: and that the Illinois factories are making rock cements. Most

of the works mentioned are new plants using the rotary kiln, and it may also be roughly stated that the rock cement mills use the dry process and the marl cement mills the wet process of mixing materials, there being but few exceptions to this rule.

The choice of eastern or northern Portland cements is thus reduced, first to the comparison of individual brands, and second to the comparison of cost, without reference to the district in which they are manufactured. The Directory has much information in descriptions of processes and of individual works and in freight rates which will aid in making a selection. Authentic reports of actual conduct in use are perhaps the most valuable indications of the worth of a cement if the use is long enough continued.

The Dromedary mixer is a drum on a pair of wheels, which is revolved by the action of drawing the cart, and should be an economical method of mixing on street work, or similar work where materials must be hauled to varying distances on account of the rapid movement of the work. The drums can be loaded at the more stationary place of delivery of the raw materials, and by the time the dumping place is reached the concrete is mixed. Reports of the use of the machine are very favorable, both as regards economy and quality of work done on long enough haul.

CONCRETE BUILDING BLOCKS.

I would like to make an inquiry in regard to Palmer's concrete building blocks. I have seen a pamphlet describing his machine and blocks, and if his claims for them are true I should think they would be a good thing, but I am under the impression that there is some drawback when it comes to practical use. Are they used very extensively? They must be heavy to handle by hand, from their size, but this might be overcome. I hardly see how he can get a very smooth surface, especially in ornamented blocks, with the proportions that he claims to use, namely, one to five. Even if he compresses them hard enough to eliminate all the little holes, I should think the surface would look coarse.

R. L. Brooker, Akron, Ohio.

On page 13 of MUNICIPAL ENGINEERING for January, 1902, will be found an article upon "Concrete Building Blocks," in which the Palmer hollow block is described and some pictures of blocks and buildings are given. With reference to the specific questions asked, it may be said that the weight of blocks of the standard size is approximately 150 pounds. A variation in the size of the hollows or in the size of the blocks will vary the weight. Probably the question of handling was carefully considered in designing the standard size. The smoothness of surface in the ornamented blocks can be judged from the photograph of one shown on page 14. It is easy to fill the face of the form with mortar of any desired richness and reduce the proportions of cement in the backing to those mentioned or even less, thus giving any desired finish or color to the surface and reducing the cost for the body of the stone. The writer has seen the blocks and finds that a good imitation of carved stone work is made.

BOOKS ON CEMENT.

I understand you have several books on cement. I would like to know the names and prices.

W. H. West, Mt. Vernon, Ohio.

The American books on cement are Jameson's "Portland Cement" ($1.50), Spalding's "Hydraulic Cement" ($2), which are general treatises on the manufacture, testing, analysis of and specifications for Portland cement, and natural hydraulic and Portland cements, respectively; "The Cement Industry" ($3), a series of descriptions of cement plants; Meade's "Chemical and Physical Examination of Portland Cement" ($1), a manual of methods of making chemical and physical examinations of cement; and the "Directory of American Cement Industries and Hand-Book for Cement Users" ($5), covering the practice in manufacture, testing and use of cement and the field of its manufacture, sale and use. There is no American book giving a detailed study of the theories of cement manufacture, of the action of the material in use, and of variations in ingredients. For a student of the theory, the first two books are valuable. For guides in practice the last two are the best.

It may be well to state here that the second edition of the "Directory" is now in active preparation for early issue. Numerous improvements are being made, and the book will be entirely reset and thoroughly revised to keep pace with the rapid development in the uses of cement and in the cement trade. Reference should be made to the advertisement on another page for a full statement of the new features.

CEMENT MANUFACTURERS ON PACIFIC COAST.

Please give us the names of cement manufacturers on the Pacific Coast and states adjoining California.

Schillinger Bros. Co., Chicago, Ill.

The first edition of the "Directory of American Cement Industries and Hand-Book for Cement Users" ($5) gives the names of the California Portland Cement Company of 104 S. Broadway, Los Ang-

eles, with works at Colton, Cal., and the Portland Cement Company of Utah, Ltd., of Salt Lake City, Utah. Both of these are in full operation. A plant at Vancouver, B. C., formerly in operation, has been closed for some time. About fifteen projects for cement works in California, Washington and British Columbia are under investigation, and some of them will be admitted to the second edition of the "Directory," although none of them, with the possible exception of one near Vancouver, are likely to be in operation this year.

CEMENT MANUFACTURERS IN THE SOUTH.

Will you please advise us of the names of Portland cement manufacturers in the South? We wish a cement suitable for sidewalk work.

The Contractors' and Builders' Supply Co., Cincinnati, Ohio.

From the "Directory of Cement Industries and Hand-Book for Cement Users" we take the following: The Chickamauga Cement Company, Rossville, Ga., has just opened works for making Portland and natural hydraulic cements from the natural rock. The Alabama Portland Cement Company, Demopolis, Ala., the Birmingham Cement Company, Ensley, Ala., and the Southern Cement Company, North Birmingham, Ala., make puzzolan cements, part of which they market as Portland cement and part as natural hydraulic cement. They do not properly belong to either class and should be termed puzzolan cements. Their use in sidewalk work is not recommended by engineers, although they are very valuable for many of the uses of Portland cement in work not exposed to the weather. The Alamo Cement Company, at Alamo, Tex., and the Texas Portland Cement Company of Dallas, Tex., are reported to manufacture both Portland and natural hydraulic cements. There are no reports in this office regarding their suitability for sidewalk work. The Iola Portland Cement Company of Iola, Kan., is a new company which has been making Portland cement for about two years, not time enough to thoroughly test its value for sidewalk work. It is purchased largely for this purpose, however. The Maryland Cement Company, Sparrow's Point, Md., makes puzzolan. The Virginia Portland Cement Company, Craigsville, Va., makes a high-class Portland cement, but the works are only about two years old. The same is true of the Buckhorn Portland Cement Company, Manheim, W. Va. The White Cliffs Portland Cement Works, White Cliffs, Ark., Crescent White Lime Company, Fayetteville, Ark., Crown Portland Cement Company, Lansdowne, Md., and Austin Portland Cement Company, Austin, Tex., are companies reported but whose works are said to be not in operation or are not yet constructed.

THE PORTLAND CEMENT INDUSTRY IN MEXICO.

We should be obliged to you for any information you may have at hand or may be able to refer us to concerning the cement industry in Mexico.

L. M. Bailey, Local Manager, Portland Cement Company of Utah, Salt Lake City, Utah.

The "Directory of American Cement Industries and Hand-Book for Cement Users" (85) reports the Compania Mexicana de Cemento, Portland, S. A., as a cement factory located at Dublan, Mexico. The company is under reconstruction, and José Watson is Director Gerente, with office in the city of Mexico.

The new edition of this book, now in preparation, will say that the consumption of Portland cement in the city of Mexico is from 500 to 600 tons a month, and is rapidly increasing, and the use in other parts of Mexico is indicated by such statements in the press as that in five weeks 2,200 wagon loads of Portland cement were passed through the custom house at Juarez to points in the interior of Mexico. Wholesale prices of Portland cement are about $8.75 Mexican, or $4.25 American currency, retail prices being about $1.50 and 75 cents higher in the respective currencies. Shipping facilities are excellent by the Mexican Central, Mexican International and Mexican National railroads, and the New York and Cuba Mail and Steamship Company. The importers in the City of Mexico are Luis, Anciaux & Co., Tarasquillo 2; R. Boker & Co., Pte. Espiritu Santo 4; Belga Drogueria, Pte. Espiritu Santo 8; Desvernine & Co., 1 Pte. San Francisco 12; E. Dutour & Co., San Agustin 8; Valentin Elcoro & Co., Cadena 24; A. Grimwood & Co., Capuchinas 8; W. C. O'Brien, Cadena 17; José Watson, Cadena 11; C. B. Woods, Tacubayo.

The United States Consular Reports give much of this information, and also that the weight of lime, hydraulic lime, natural and Portland cement imported in the fiscal year 1899–1900, was about 59 million pounds, of which England furnished about 28 million, Germany 11 million, the United States and Belgium each about 9 million. A separation of the various kinds of cement and lime is not made in the custom house.

FORMS FOR TABULATING MUNICIPAL DATA.

I understand that forms have been prepared for tabulating municipal data, which were presented to the American Society of Municipal Improvements. How can I obtain a copy of them? Also any further information relative to changes or any additional data. *L. W. Anderson,*
City Engineer, Grand Rapids, Mich.

The forms referred to were first presented to the American Society of Municipal Improvements at its meeting in Washington in 1898, and are printed in the proceedings of the society for that year. They have been before the society for discussion since that time, and were again printed in the proceedings for 1900. The editor of MUNICIPAL ENGINEERING has been the chairman of the committee each year. The subject of uniformity in municipal reports has been under discussion for several years in several national societies, and some progress is now becoming apparent. Further reports will be presented at coming meetings of these societies. Copies of the volumes of proceedings referred to can be obtained of George W. Tillson, Municipal Building, Brooklyn, N. Y., the secretary of the society. The forms as first presented to the society were printed in MUNICIPAL ENGINEERING on page 293, November, 1898, and page 34, January, 1899.

OFFICERS OF MUNICIPAL IMPROVEMENT ASSOCIATIONS.

With reference to the query under this heading, on page 85 of the February number, it has been suggested that size of city is not an indication of value of the activity of civic improvement societies, some of the best work being done by societies in small towns and villages. There are three booklets issued by the American League for Civic Improvement which offer a large amount of general information regarding the work of such societies and methods of organizing them.

BUILDING REGULATIONS IN LARGE CITIES.

I perform the duties of chief engineer and inspector of construction in a city, and I am considering a reform in our building construction code, the present provisions being superannuated and not commensurate with the increased population, which is now more than 250,000. Can you refer me to works treating in detail the subject of preparation, consideration and criticism of building codes in the United States and Canada, and make known to your many readers who occupy positions similar to my own the great interest which I have in municipal legislation in force in their cities?
V. da Silva Freire, Sao Paulo, Brazil.

Each city has its own building code, a copy of which can doubtless be obtained upon application to the "Building Inspector," who is usually an employe of the department of public works. The New York building law is taken as the model for many cities, and a copy can be secured by writing to the department of buildings. Birkmire's "Planning and Construction of American Theaters" ($3) describes the construction of many theaters in the larger cities, and is said to give the New York building law. His "Architectural Iron and Steel" ($3.50) discusses the application of these materials in the construction of buildings, and is also said to give the New York building law. Price's "Hand-book on Sanitation" ($1.50) discusses the sanitary features of building codes, and gives the tenement-house law of the state of New York, the provisions regarding tenement houses in the New York city charter, the plumbing, drainage, water supply and ventilation regulations of the department of buildings of the city of New York.

Our readers who can send our correspondent copies of the building codes in their own cities will confer a favor upon him which will be appreciated.

A CARD INDEX FOR MUNICIPAL ENGINEERING.

As I am going to start a card index for the magazine so as to be able to know at a glance where a certain article is, could you give any advice on the subject? Have you a complete index to the present time or any part of one?
Geo. W. Bagge, Melrose, Mass.

The fullness of an index depends upon the use which is to be made of it. One to be published will usually be much more restricted than one for individual use. An index reduced to its lowest terms will enter each article under the word or words in the title which best represent its contents. Here, too, the character of the book makes some difference in the fullness of the index. Taking the first article in the February number as an example, in some cases an entry under Pavement would be sufficient, but if Macadam, Bituminous and Massachusetts are also subjects of interest, entries may be made under them also. The interests of the maker of a card index determine largely the extent of his entries. One should never be so saving of time and space, however, as to neglect entirely subjects of importance, though he is not interested in them at the time of making the index.

The editor's index must necessarily be more extensive, and the entries in his index for the article used as example, are as follows:

Bituminous Macadam Pavement in Massachusetts, XXII, 65.

Macadam Pavement, Bituminous, in Massachusetts, XXII, 65.
Pavement, Bituminous Macadam in Massachusetts, XXII, 65.
Massachusetts, Bituminous Macadam Pavement in, XXII, 65.
Cambridge, Mass., Bituminous Macadam Pavement in, XXII, 65.
Brown, Chas. A., Superintendent of Streets, Cambridge, Mass., Bituminous Macadam, XXII, 65.
Warren Brothers Company, Bituminous Macadam Pavement in Massachusetts, XXII, 65.
Brockton, Mass., Bituminous Macadam Pavement in, XXII, 65.

If the article is not prepared by the editorial force an entry of it is also made under the author's name. Articles in departments are marked E for editorial, Q for question, L for municipal matters in court, C for current information, M for machinery and trade, etc. Any branches of a subject or any new matters in an article not fully covered by the title are also entered in the index under a proper heading.

The editor's index is now in preparation for all the volumes of the magazine, but only the last three volumes have been gone over for the first trial. The whole will be completed as rapidly as possible, and if there is sufficient demand for a complete index one will be made up from the card index and printed for distribution. It would necessarily be much less detailed than the card index described.

INTER-STATE CONSTRUCTION COMPANY.

We have recently addressed letters to a company advertising as The Inter-State Construction Company of Fort Wayne, Ind., all of which have been returned to us. What do you know about the existence of this company? *F. A. W.,*
Lancaster, Ohio.

Other instances of the same experience as our correspondent's have been reported to us. We have no information regarding the company.

BOOKS ON CENTRAL HEATING PLANTS.

Where can I get the best book on designing of central heating plants, both hot water and steam?
W. C. Lemen, City Engineer,
Paris, Ill.

The general use of central heating plants is so recent in its beginning that no books upon the subject are yet available. Another reason for the lack of books, perhaps, is the fact that most of the special appliances used in practice are patented, and the different systems in use have been developed upon the basis of these patents. Such books as Baldwin's "Steam Heating for Buildings" ($2.50) and "Hot Water Heating and Fitting" ($2.50) give the principles upon which the systems are based and the practice regarding the installation of house systems. A study of the trade catalogues of the companies engaged in the construction of central heating plants and of articles in engineering papers and before technical societies will give some idea of the special details necessary for successful application of the central station to the supply of the wants of the individual buildings. Several of such articles have appeared in MUNICIPAL ENGINEERING and others are in preparation for future publication. See page 29, January, 1902; 151, September, 1901; 195 and 243, April, 1901; 136 and 151, March, 1901; 65 and 112, February, 1901; 20, January, 1901; 412 and 425, December, 1900; 363, November, 1900; 212 and 218, September, 1900; 35, July, 1900; 351, June, 1900. Reference may be made to our advertising columns, also.

MANUFACTURERS OF CEMENT MACHINERY.

We are requested by a customer abroad to furnish estimate on a complete plant capable of turning out 400 barrels of cement daily. We would ask that you be good enough to give us the names of manufacturers of cement machinery, so that we may correspond with them.
The Fairbanks Co.,
311 Broadway, New York.

The best source of this information is the Directory list of "Machinery and Supplies for Cement Plants" in the "Directory of American Cement Industries and Handbook for Cement Users" ($5). Special machinery for use in cement plants will be found under such headings as ball mills, steel balls, clinker coolers, crushers, dryers, feed pipes, grinding machinery, grit mills, rotary kilns, lining for kilns, pebbles, pebble mills, pulverizers, tube mills. The ordinary power generating and transmitting machinery and appliances, conveying machinery, etc., will be found under their appropriate heads.

Reference may be made also to the Directory list under the heading "Cement Tests and Analyses" for the names of engineers designing cement plants as persons who can give assistance in making such estimates.

CONTINUOUS CONCRETE MIXERS.

Can you give me some information regarding continuous concrete mixers and manufacturers of the same? *Rudolph Riesen & Son Co.,*
Milwaukee, Wis.

A portable continuous concrete mixer which has the reputation of doing excellent work is shown and described on page 258 of

MUNICIPAL ENGINEERING for October, 1901. It is made by the Jeffrey Manufacturing Company, of Columbus, Ohio. Its main feature as a mixer is a spiral conveyor specially designed for mixing and turning and at the same time carrying the concrete forward. The Contractors' Plant Company, of Boston, Mass., has a portable gravity mixer which is adjustable to any desired use and is also very satisfactory. The Ransome and Smith Company, of New York, advertises an automatic measuring and mixing machine of large size, which should do good work. No reports regarding its use are at hand, however. The Drake Standard Machine Works, of Chicago, make a number of styles of concrete mixers for different kinds of concrete work.

INFORMATION ABOUT CONCRETE BRIDGES AND ARCHES.

I should like to be put in possession of information regarding concrete bridge structures, methods of framing, etc.

Wm. F. Bowe, Augusta, Ga.

Can you direct me to where I can obtain information as to concrete bridge arches (segmental or elliptical), in spans of 30 feet and upwards?

T. A. S. Hay, Town Engineer,
Peterborough, Ont.

The methods of computing concrete arches are similar to those of computing stone arches. The lagging on the centers must be specially designed to produce the proper surface and not spoil it by swelling when the wet concrete is deposited on it. Aside from this their discussion does not differ from that of arches in other like materials. In this number will be found a valuable description of the construction of a concrete arch. On page 63 of MUNICIPAL ENGINEERING for February, 1901, will be found a description of Melan arches constructed in Indianapolis, and on page 388, December, 1900, Mr. Luten gives a discussion of a form of reinforced concrete arch designed by him. Specifications for several arches are given in the "Directory of American Cement Industries and Hand-Book for Cement Users" ($5).

CRACKS IN A CEMENT FLOOR.

A Portland cement concrete floor with metal reinforcement was laid in the second story of a papermill on steel girders. There comes on the floor liquid of about 210 degrees temperature, and the floor has cracked so as to leak badly. The basement floors do not crack. The owners propose to remedy the fault by covering the floor with asphalt and putting on a top dressing of Portland cement for wearing surface, claiming that the asphalt will not crack. I believe they can not bond the cement top to the asphalt, and that if they do, the large expansion and contraction of the asphalt will crack the top coat of cement. Also, that I can put a 4-inch floor on top of theirs of Portland cement concrete and dress the top with soap and alum and make it water-tight. They admit that the top may crack, but contend that the asphalt will stop water from going through. What information can you give me on these points?

Chas. Whitney, Fulton, N. Y.

The cement floor on the second story has doubtlesss cracked because of the great range of temperature to which it has been subjected and the failure to make proper provision for expansion and contraction. In a building under ordinary conditions little or no such allowance is necessary, but this is a special case. The proposed new floor of cement whether on the present floor or on a layer of asphalt may be expected to crack in the same way if no allowance for expansion is made. It would be well in either case to cut the wearing surface into blocks of convenient size, leaving joints to be filled with some elastic material, such as asphalt, thus concentrating the action of expansion and contraction where provision is made for it. These joints may not be waterproof at all times and so it would be well to put a waterproof coat under them. Asphalt is probably as good as anything. If the design is such that there is no danger of the blocks cracking, this asphalt coat need extend only a short distance either way from the joint, especially if a channel of metal or cement is laid in it with sufficient slope to carry the water which may come through the joint to a fixed point of discharge. To insure no leakage, the asphalt coat may be extended over the whole surface, and the cement top laid on this. Even then, some slope may be given to the surface of the asphalt and provision be made to collect the water finding its way to the bottom of the slope. The cement and asphalt will probably not bond together; in fact, it is well that they do not. Asphalt is so plastic that any expansion can be taken up by a flow of the material into the joints between the cement blocks or into other convenient crevices, and it is not likely to expand and contract enough under the circumstances described to form cracks large enough to permit leakage to any extent. A waterproof coating may be put on the cement blocks, as suggested, if the asphalt is not laid over the whole floor. A thickness of four inches of concrete is hardly necessary. Reference should be made to other articles in this department this month on cracking and expansion of concrete, in which will be found also lists of previous discussions of similar questions.

MATERIAL FOR INVERTED SIPHON.

With reference to the use of concrete in an inverted siphon for carrying sewage across a depression, considered under the above heading on page 93 of the February number, the following has been selected from letters written by Mr. Thomas Franklin, of San Antonio, Tex.:

"In 1894 I constructed a storm-water sewer of concrete, consisting of 550 feet of 36 inches diameter with 5-inch ring, and 450 feet of 30-inch, with 4-inch ring. Another was built in 1896 about 1,000 feet long with 30-inch semi-circular top, vertical sides 5 inches thick, and invert 3 inches thick. This was extended about 400 feet in 1901. These were constructed under my own plans and specifications, and I had so much confidence in my work and the quality of cement used—Alamo Portland, manufactured here—that I gave bond to the total cost of each sewer for maintenance for one year. At this writing both are in perfect condition. The city outfall sewer was constructed in 1897. Immediately there was a great popular outcry by the residents along the river. One fellow got judgment against the city, and it has become necessary for the city to do something. One project is to divert the sewage to a place called Mitchell's Lake, about six miles below the sewer farm. I have completed location for a line. In crossing valleys I intend using inverted siphons of cement concrete, because I have never seen or heard of lumber flumes which did not leak when a few years old, whereas the concrete siphon will be imperishable. For thirty or more years I have been a strong advocate of concrete for structural purposes, and have used it in cases where others would have used other materials. When the aggregates are properly proportioned, great care being taken in the mixing and use of water, with careful, honest workmanship, I do not consider that there is the least chance for failure. As to withstanding the bursting pressure, aside from my knowledge of the sewers of Brussels, where the aggregates were 1, 6 and 12 and 1, 4 and 8, I have object-lessons at home. I know of an above-ground cistern about 12 feet high, 8 or 10 feet internal diameter, about 5-inch concrete shell, without wire or other reinforcement, which has stood full of water for years without crack or break."

He cites inverted siphons under roads of field stone set in lime and cement mortar and of pine lumber, and claims a large factor of safety for his proposed concrete siphon. He continues:

"There will be four to six of the siphons, one about 2,000 feet long, greatest depth 30 feet, another 900 feet long, greatest depth 18 feet. I do not altogether approve of the use of wire netting, twisted wire, etc., for increasing the strength of concrete, because it is unnecessary, the concrete being strong enough; because it does not prevent cracking; because its presence prevents thorough ramming and a homogeneous mass is not obtained unless the concrete is used very wet."

Mr. Franklin's remarks do not change the opinion of the writer of the answer to the question in the February number, and the precautions there suggested are repeated, especially with reference to the siphons under 18 and 30 feet head. All but one of the concrete structures referred to are under compression and not subjected to constant fluid pressure and the danger of leakage if cracks form.

RAILWAY CONTRACTORS.

Will you furnish me the addresses of some financially strong railway contractors and builders?

John Lee Stark, Mexico City, Mex.

Reference may be made to our advertising columns. Those advertising railroad work as a specialty are J. U. Fritchey, Lancaster, Pa., and Wm. H. Luchtenberg, Columbus, Ohio. Others doing some branches of railroad work are F. H. Kirchner & Co., Temple Court, Cincinnati, Ohio, and the B. M. and J. F. Shanley Co., 14 S. Broad street, Philadelphia, Pa.

METHODS AND TOOLS FOR LAYING ASPHALT.

As I am about to do asphalt paving in connection with my present work, I would like to gain some information in regard to the general rules for laying of asphalt; also the best place to purchase tools for such work. *J. L.,*

Cincinnati, Ohio.

Reference for some of the information desired may be made to the article on the municipal asphalt plant in Winnipeg, in this number. As stated in that article, the mixing and laying of asphalt work is not a matter which can be reduced to the application of rules by inexperienced men. The variations in quality of asphalt, stone, sand, temperature and other weather conditions, etc., so modify the general theoretical rules that their proper application can only be entrusted to those who have had much experience and have been able to profit by it. Work done by inexperienced men under supervision of inexperienced contractors or foremen can not be guaranteed. It may be good and it may not.

Some assistance can be found in reading such books as Delano's "Twenty Years' Practical Experience of Natural Asphalt and Mineral Bitumen" (50 cents) and the study of specifications for asphalt pavements in such books as Tillson's "Street Pavements and Paving Materials" ($4). The reports of the inspector of asphalts for the Engineer Department of the District of Columbia, Washington, D. C., are also valuable sources of information. They are written from the inspector's standpoint, but contain much of value to the contractor and asphalt worker.

PREPARATION OF MACADAM STREET FOR NEW BRICK SURFACE.

Our soil here is sand and the original sub-grade had some crown. We put on this about two feet of gravel in the center of the street and about six inches at the sides. This gravel contains a great deal of clay, and is very hard when dry but muddy in wet weather. In putting brick pavement on this street, would it be necessary to remove all of this gravel, because it will not allow any water to pass and will get soft, or will it only be necessary to remove one foot in the center of the street? Sketch accompanies. *J. S. Haines, City Surveyor, Dowagiac, Mich.*

The sketch shows a very heavy crown from which it is proposed to remove one foot to the subgrade of the pavement, which will be replaced by one foot of brick surface and foundation. The crown will be still further reduced by filling the gutter 6 inches to the new subgrade and one foot by the new brick surface and foundation. No width of pavement is stated, nor is the crown remaining stated. The character of foundation is not given, but it is evidently to be 8 inches deep.

In general it would not be possible to fill the gutters 1½ feet as is here proposed, but it is doubtless possible in this case or it would not be proposed. The crown of a brick street, according to Mr. Rosewater, should be one-sixtieth of the width if the street is level, and less if it has an appreciable longitudinal slope. If the pavement is to be laid on a foundation of gravel or broken stone, the crown should be a little more than this rule would give.

The amount of excavation of the old macadam or gravel street at the center is thus fixed by the amount the gutter can be filled, and the elevation at the center of the street will usually be somewhat below what it was for the gravel street. Certainly the gravel in such a street remaining after such excavation should be sufficient subfoundation for a pavement with an additional eight inches of foundation and a brick surface, even if it will hold water. No water would reach it through a first-class brick pavement on concrete foundation, and very little through any pavement which it is worth while to lay. In some cases where the old gravel or macadam is not too completely excavated on account of the demands of reduction in crown for the brick surface, it can be used as foundation, adding only a little broken stone or gravel to take out inequalities or fill bad spots, and a sand cushion, before laying the brick. This would possibly not be advisable in this case

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THE USE OF CONCRETE IN SEWER CONSTRUCTION.*

By Harry V. Gifford, Toledo, Ohio,

It seems somewhat strange when we consider the various and almost unlimited uses to which concrete has been put in both Europe and America that it has not been generally employed in sewers. Of course its use in foundations and cradles has been extensive, but examples where the entire sewer has been built of concrete are comparatively few. In Brussels the storm flow of the Maelbeek Creek has been turned through a concrete sewer, varying in form to suit local conditions, from a circle with a 15 foot radius to a section 30 feet across and 9 feet high. In 1894 a sewer was built in New York of large concrete blocks. It was rectangular in cross-section, with a foundation of piles and the top of steel I-beams and concrete. In Boston different forms have been used to fill certain local conditions. For instance, an inverted siphon was laid under Malden River, made of wooden staves, held together with steel straps on the outside, and lined on the inside with 4 inches of concrete.

At Washington concrete has been used more extensively than in any other city in this country. Their specifications call for monolithic concrete shells from 10 to 13 inches in thickness, according to the diameter of the sewer. An arc of 120 degrees on the bottom of the invert, is lined with vitrified brick, and an arc of ..

*From a paper before the Michigan Engineering Society.

degrees on each side of this, with red brick. The top of the arch is covered with Portland cement plaster ⅝ inches thick. In Reading, Pa., two miles of such sewer have been built, varying from 3 to 14 feet in diameter, but with the brick lining omitted. In Salt Lake City a gravity outlet sewer was built in 1894 between 6 and 7 miles long and varying in diameter from 38 to 64 inches. The bottom two-thirds of the circumference was a monolithic concrete shell of varying thickness; the top one-third was arched with brick. These are some of the examples in this country.

The concrete sewer constructed at Coldwater, Mich., last fall by the speaker as engineer in charge of construction was unlike any of the concrete sewers just described, and yet was somewhat similar to some of them. It was, as far as I know, the first one of its design ever built. The city of Coldwater has a population of 6,216 according to the census of 1900, and is built upon an exceedingly flat stretch of ground. The streets have never been properly graded, and very naturally some difficulty has been experienced in getting the surface water in time of storms to run in any particular direction.

Some fifteen years ago an 18-inch tile sewer, if such it may be called, for it was "ring" joints without the ring and laid with a carpenter's level, was built for a trunk storm water sewer on Clay-st., from Peckham-st. to Coldwater river, a distance of some 1,600 feet. From year to year branch after branch has been added, regardless of size or anything else, except that it would furnish a temporary drainage for an individual's property. The result of all these so-called improvements was that in time of storm the capacity of the trunk sewer was too small, and the backed-up water would rush in floods over sidewalks and lawns as if no sewers existed.

During the past summer the firm of Riggs & Sherman of Toledo was called in to design a new trunk sewer, and after looking over the ground they decided upon a circular sewer three and a half feet in diameter. The subsoil, which underlies about eighteen inches of hard pan, is a loose gravel of excellent quality, very free from clay or organic impurities, and in limitless quantities; and some of the very best of American Portland cement could be obtained there for $1.35 a barrel, delivered on the work. These facts, together with some others, led the engineers to recommend a sewer built entirely of concrete. Bids were asked on three separate designs: (1) brick; (2) concrete, with the invert a monolith 8 inches thick and semi-circular in form and the arch composed of eleven concrete blocks; (3) concrete, built entirely of blocks. The detail plan of these blocks called for a length of twenty-four inches, the intrados to conform to the arc of the sewer, subtended by a chord 5¾ inches long, the extrados a chord 8 inches long, the coursing joints being of course 8 inches through. The lowest bid was $3.40 per lineal foot for brick and $3.00 per

CONCRETE SEWER, COLDWATER, MICH.

lineal foot for concrete, with block arch and monolithic invert, the bids on complete concrete block sewer being rejected. The bid was let for the concrete sewer at $3.00 per foot.

The work to prepare the blocks was started early in September. Some 8,500 were required, and in order to give them as much time as possible to set, the majority of this work was done before excavation on the trench was started. Molds were made of 2-inch lumber and lined with tin, and the four sides of the mold formed the extrados, intrados and two ends of the block, the remaining two sides being open and the whole held together by screw or wedge-clamps. The molds were not at first lined with tin, but after a little use the concrete stuck to the sides when the mold was removed. We found that the tin entirely remedied this difficulty. The mold when put together was laid upon a mold-board 1 inch by 12 inches by 30 inches reinforced by cleats across the bottom. When the block was completed the mold was carefully taken apart and mold-board and block were carried out and laid down upon a stretch of sand that had been leveled off to receive them. The block was left upon the board until, by careful handling, it could be removed without injuring it. The length of this time depended entirely upon the weather—sometimes 24 hours was sufficient, sometimes two days. After being removed from the board it was laid upon the ground and allowed to remain there for three days, after which it was placed upon the pile. After the blocks were 24 hours old, they were watered several times each day for at least a week, and in all handling great care was exercised to protect the inside face. Very few blocks were broken, which was rather remarkable, considering their weight of 90 pounds each and the green condition in which they were handled.

A gang of 14 men were all that could be readily worked with the room we had at our disposal. Two men to screen gravel, four to mix concrete, four molders, three men to shift and water blocks and one foreman. The work was done in a gravel pit owned by the city, and this materially reduced the cost of the blocks because of less expense attached to the handling of the gravel. Another thing which worked great benefit to the contractor was the fact that he did not have to pay for the gravel, but to offset this he afterward gave the city whatever gravel they needed from the trench. With a little practice, each molder could turn out 175 blocks a day. Each batch of concrete containing one-half barrel of cement would average 18 blocks. This would make the cost of each block between 11 and 12 cents, figuring in 0.85 of a cent on each block for use of molds and mold-boards, which were entirely lost. It is my belief that it would have been more satisfactory had the blocks been 18 inches long instead of 24. Although a man can make a block 24 inches long about as quickly as one 18 inches, and it is not necessary to handle as many blocks to build a given distance of arch, yet the greater rapidity and ease with which the smaller blocks can be handled and the decreased liability to break or chip them, would offset the advantages of the longer block, from the contractor's standpoint as well as that of the engineer.

The matter of mixing concrete has been so thoroughly threshed out in engineering publications, and is undoubtedly so familiar to all of us, that I shall only refer to it briefly. The gravel that we obtained from the bank was of an excellent character, and very free from clay or other impurities. A stratum of pebbles from which all the sand had been washed, ran horizontally through the bank. These pebbles, when caved down and mixed with the gravel beneath, easily balanced whatever surplus of sand occurred in the other gravel. This was all screened through a riddle with meshes 1 inch apart. The concrete was mixed in the proportions of one part American Portland cement to six parts of gravel—the only point of interest in connection with the mixing being the proper amount of water. If too much water was used the concrete would stick to the molds, and after the mold had been removed would fall apart, or at least lose its proper shape. On the other hand, if not enough water was used the outside, and especially the corners, would dry out before the concrete had set. This made a crumbly block. We found the proper consistency to be such that when smartly struck with the back of a shovel moisture would appear on the surface, or such that, after being rammed in the mold, water appeared upon the sides of the block.

The material encountered in digging the trench was the same loose, clean gravel that we got from the pit, with the exception of the bottom foot or two, which, in some places, was a sandy loam. Every foot had to be sheathed and thoroughly braced, and constant watch kept on the banks even then, for they would crack off in long stretches from three to five feet back of the sheathing. The horizontal method of sheathing was first used and proved quite disastrous to the contractor, for in driving it down it greatly increased the natural tendencies of the

banks to cave. It could not be as easily handled as the vertical form, and after the top part was removed the banks would cave, making it impossible to get out the lower courses. In fact the method is ill-adapted to the character of ground at Coldwater, and after we had started to use the vertical method the work progressed much more rapidly and satisfactorily. With the exception of going under the main line and four side tracks of the Lake Shore railroad, with a cut of fifteen feet, no particular difficulty was experienced in the excavation.

When the trenching had reached the approximate grade of the top of the invert, stakes were driven in the bottom about 5 or 6 feet apart, and in a line equal to the distance of the radius, plus the thickness of the shell, plus ⅛ inch each side of the center line, as determined by a plumb bob from lines on the surface. These stakes were driven to such a grade that the top of a 2x4 set edgewise upon them would be the proper grade of the top of the invert. The invert was then excavated to approximately conform to the outside of the finished sewer, and was then made to exactly conform by a semi-circular templet of the proper dimensions, drawn along the runners. Where gravel was found in the bottom it was impossible to hold the shape exactly, but where loam was found the excavation could be made perfectly true. Concrete was then thrown in and with shovels and rammers was worked into approximate form without the use of moulds. The only part that was difficult was to get the inside shoulder on both sides to stand up square. This could be accomplished by holding a float or a board along the inside, filling in behind it with concrete and tamping it down. We tried the use of a form in making the invert, which was built very much like the center used for arches of brick sewers, except that about 1-3 of the center of the arc was left out. This form was about six feet in length and was suspended in an inverted position from the cross-boards resting upon the runners. The bottom of the invert for about one-third of the semicircle was made to approximate dimensions; the form was then set on the runners over this partially prepared spot and concrete was filled in on both sides, between the outside of the form and the side of the trench, and thoroughly rammed. The form could then be lifted off and the invert trued up. This gave very good results, the only objection to it (and an objection which was great enough to cause its rejection), was that the form was too large and clumsy and was in the way of the workmen. It could be used with success in a soil where the excavation could be prepared a number of feet ahead, so that the form could be

MAKING BLOCKS FOR CONCRETE SEWER, COLDWATER, MICH.

drawn along as each section was completed, but in a soil, as at Coldwater, where the placing of the concrete must closely follow the preparation for the invert, this form was in the way. Either method gave an approximate form to the concrete, which was trued up by means of a semi-circular templet with a radius of 21½ inches. This left the surface of the concrete ½ inch larger than the finished invert. While the concrete was yet green, a heavy coat of mortar, composed of one part of cement to two parts of sand, was roughly troweled on. This in turn was brought to its true dimensions by drawing along the runners a third semi-circular templet with a 21 inch radius. This left the surface perfectly true, and both concrete and plaster of proper thickness. It resembled a concrete walk which had been finished with a float. We tried smoothing it down with a trowel. but when a templet was applied to a section thus treated, it was found to be so far from its true form that the practice was given up after the first day. When finished it was much smoother and truer and offered less resistance to the flow of water than the invert of a brick sewer.

When the coat of plaster had become hard enough so that a man could walk upon it without injuring it, two tiers of blocks were laid up to a line upon either shoulder of the invert. The mortar was composed of one part of American Portland cement, two parts of sand and one-quarter part of slacked lime plaster. This lime made the mortar so much richer and so much better to work and the joints were so much better laid that it fully offset what little weakening effect it had, if any.

The form of the center was then put in place and the rest of the arch built up, care being taken to break joints. As each section (about 8 feet in length) was completed, a thin grout of equal parts of cement and sand was poured over the top and worked into all the joints. Gravel was thrown upon each shoulder of the arch and tamped down and the center moved ahead. In back-filling we tried to arrange to cover at least 18 inches over the top of the arch and let it stand for 24 hours, but in some cases, where several feet of earth was filled in before the arch was 12 hours old, observations failed to disclose any dislocation of the arch-blocks or injury to the invert.

The man-holes were built of brick, commencing on the top of the invert at either side, and were built upon and dovetailed into the arch. Pipe connections were made by setting one joint of pipe in place and building the concrete around it as the work progressed. A bulkhead was built at the river with a concrete foundation two feet deep, three feet thick, fourteen feet long, the upper part being of rubble masonry, one end of which was dovetailed into the wing of an adjoining abutment. A coping was built of concrete 4 inches thick. In some catch-basins that were afterward built we made use of some of the surplus blocks. The excavation was made as usual and a 6-inch foundation of concrete was laid. Upon this twenty-five blocks were set upon end in a circle, every other one being a half block. On top of each half block a whole block was laid, then the brick work was started, building up the lower ones until level with the higher ones, and completing the catch-basin with ordinary brick work. This simply suggests one more use for concrete.

Some idea as to the degree of strength to which the sewer will ultimately attain may be shown by this small incident: We had occasion to cut a hole through the invert for a 15-inch connection, when the sewer was about a month old. The trench had been excavated to the bottom of the sewer on the outside and two men, provided with heavy coldchisels and hammers—one on the inside and one on the outside—occupied a day and a half in cuting the hole. To ascertain the tensile strength of the concrete, the writer made some tests, in person, at the laboratory of the Michigan Portland Cement Company, with proportion of one part of cement taken from sacks, on the work, to six parts of sand. Four briquettes broken after twelve hours in the air and twelve hours in steam, averaged 215 pounds, the maximum being 250 pounds. This accelerated steam test is, I believe, approximately equivalent to the seven-day test. We tried to test some of the blocks for cross-breaking strength, but were unable to get sufficient weight to break them.

In Washington it is the custom to pave the inverts of concrete sewers with vitrified brick, but it seems to be a question whether the ordinary wear in a storm-water sewer is so great that a half-inch coating of rich Portland cement plaster will not withstand it. Certainly neater work can be done by omitting brick. An objection which might be raised against the concrete sewer, would be that in places where manufacturing wastes get into the sewer certain acids might have a disintegrating effect upon the concrete. That might be true in a combined system, but even then, I think, could be remedied by coating the inside with tar or asphalt. The greatest objection would be that the cost would be greater than that for a brick sewer in certain locali-

ties, and sufficient data are not obtainable to state in what degree this objection would hold. In Wilmington, Del., a brick sewer was built on a stone cradle at a cost of $14.84 per ft. This sewer was afterward extended, built entirely of concrete, at a cost of $10.20 per foot, using crushed stone instead of gravel. The sewer at Coldwater was cheaper than brick sewer would have been. In almost any locality, gravel or crushed stone can be obtained without excessive cost, and at almost any place east of the Mississippi, good cement can be obtained at a reasonable figure. And when we take into consideration the increasing strength and durability of concrete in the ground, it would seem that at no very distant date the brick sewer must look for a strong rival in the form of concrete.

MUNICIPAL MATTERS IN COURT.

[Prepared for MUNICIPAL ENGINEERING MAGAZINE by Andrews & Murdoch.]

Defective Sewer. — Overflow—Punitive damages are not recoverable against a municipal corporation for injuries to land caused by the overflow of a creek in a time of severe storm, caused by the discharge of water into it from a defective sewerage system. Costich vs. City of Rochester, 73 N. Y. Supp. 835.

Defective Ordinance—Where a city ordinance for improving a street provides that the curbstones shall be firmly bedded on flat stones, but does not otherwise describe such flat stones, the ordinance is defective, and an assessment for such improvement cannot be enforced. Beach vs. City of Chicago, 61 N. E. Rep. (Ill.) 1,015.

Fire Limits.—Permission to Repair Wooden Building—A resolution of a city council permitting a person to repair a wooden building within the fire limits does not authorize the removal of the building to another place within the limits, where the ordinance relating to fire limits prohibits the "erection or placing" of wooden buildings within the fire district. Griffin vs. City of Gloversville, 73 N. Y. Supp. 684.

Extension of Drains Beyond City Limits—A city which is authorized by its charter to construct sewers and drains, and to do all other acts which may be necessary for the promotion of health and to prevent t..e spread of contagious diseases within the city, has power, in constructing a general system of drainage, to extend the same to a proper outlet without the limits of the city. Minnesota & M. Land and Improvement Company vs. City of Billings et al., 111 Fed. Rep. (U. S.) 972.

Curbing Required by Ordinance—A city ordinance ordering a sidewalk to be built between the property line and the curb line of the street, the said curbing to be put along the edge of the sidewalk and twelve feet from the property line, and prescribing the size and kind of curbing, which should be bushhammered twelve inches down the face and four inches on top, requires the construction of a curbing for the roadway of the street. Job et al: vs. People ex rel. Tetherington, 61 N. E. Rep. (Ill.) 1079.

Public Works.—Estimates—Where a contract for public works stipulated that the water commissioner should determine the amount of the several kinds of work to be paid for, and that his estimate should be final, in the absence of fraud his estimates were conclusive, though items considered and rejected, and for which suit was subsequently brought, were not shown in his account. McCormick vs. City of St. Louis, 65 S. W. Rep. (Mo.) 1038.

Cost of Curbing. — Apportionment — Where no sidewalk had ever been constructed, and there was not sufficient space abutting on the street belonging to the city to allow the construction of a sidewalk, the curbing was a part of the street and should be apportioned to the number of square feet owned by the lot owners in the fourth of a square contiguous to the improvement, and not according to the front feet. Marshall et al. vs. Barber Asphalt Paving Company, 66 S. W. Rep. (Ky.) 182.

Cost of Construction of Sidewalk—The report of a committee of the cost of the construction of a sidewalk, which followed the terms of the contract, which was awarded by public advertisement and bidding at a certain price per square foot for materials and a certain price per square foot for labor, will be deemed sufficient, though it omits the cost of grading, the presumption being that there was no grading unless it is included in the item of labor. Ronan et al. vs. People ex rel. Shafter, 61 N. E. Rep. (Ill.) 1042.

Act of God.—Negligence—The opening of a sewer on defendant's land became choked with weeds, cut grass, etc., causing the water to flow into plaintiff's house, and plaintiff claimed that defend-

ant had been negligent in allowing the grass to lie along the water courses and near the opening; and the defense was extraordinary rainfalls, amounting to an act of God. Held, that defendant was not liable if the extraordinary rainfall would have caused the injury, notwithstanding any negligence on the part of defendant. Helbling vs. Allegheny Cemetery Company, 50 At. Rep. (Pa.) 970.

Ordinance as to Width and Depth of Sidewalk—An ordinance for a cement sidewalk provided that it should be constructed under the supervision of the inspector, and that the space for the walk should be excavated to the proper depth and width. An ordinance adopted the preceding year provided that all sidewalks laid on such streets should be five feet four inches in width. Held, that the width prescribed by such former ordinance is not incorporated into the later one by the use of the words "proper depth and width," and that such words do not prescribe any definite width. People ex rel. Raymond, County Treasurer, vs. Hills, 61 N. E. Rep. (Ill.) 1061.

Plans and Profiles.—Delegation of Authority—Where a resolution of intention and a contract in street improvement proceedings provided that the improvement should be made in accordance with the plans and profile and specifications, and the specifications provided that the contractor should "put in such culverts as the street superintendent might direct," while the plans and profile required only two culverts, which were specifically described, the specific description and designation of the two culverts in the plans and profile did not cure the fault of the specifications in giving the street superintendent unwarranted authority with reference to the culverts. Grant et al. vs. Barber et al., 67 Pac. Rep. (Cal.) 127.

Charter Provision as to Personal Injuries—A city charter provided that the corporation should not be liable for any injuries sustained owing to the defective condition of sidewalks, etc., unless such condition should have continued for ten days after notice to the mayor or certain committees. A city sold certain fences on property through which a street was opened, and authorized the purchaser to remove them, which he did to the knowledge of the city, but he failed to fill a hole left where a fence post was removed, and subsequently a pedestrian stepped into such hole, it being just beside the sidewalk. Held, that though no notice of such hole had been given, the charter provision did not protect the city, inasmuch as the act of the purchaser was, under the circumstances, to be considered the act of the city, and the provision had no application to such case. Still vs. City of Houston, 66 S. W. Rep. (Tex.), 76.

CURRENT INFORMATION.

Canal Street Paving Case in New Orleans.

A decision unfavorable to the city of New Orleans has been rendered by the Louisiana supreme court in the Canal-st. paving case. The proposed paving, which was described on page 100 of the February, 1902, issue of Municipal Engineering, included 14,500 lineal feet of Canal-st., in two roadways, each 35 feet wide on each side of a neutral ground 50 feet wide in the center. The Louisiana Improvement company bid $1.99 a square yard, including pavement, subsurface drainage and all other necessary work, making a total of $302,115.50. Before the contract was signed, however, a tax-payer applied for an injunction to restrain the city from signing, which was refused by the lower court. It was then carried to the supreme court. The litigation involved the following:

1. The right of the city to order the repaving of a street previously paved by assessment upon which the period of maintenance had not expired.
2. The right of the city to dispose, as it might elect, of the materials composing the original pavement.
3. The right of the city to average the cost of the new pavement by the lineal foot of property frontage, a certain length of the street being 37 feet 3 inches wide, a certain length being 35 feet wide and a certain length being 30 feet wide.
4. The right of the city to anticipate future revenues to pay the city's portion of the cost of the pavement.

The court ruled in favor of the city on all points except that stated in No. 4.

W. J. Hardee, city engineer of New Orleans, who furnished us the above information, says:

The right of the city to anticipate future revenues to pay for public improvements has been a mooted question for years among our best lawyers. In the case of contracts involving small amounts, paving contractors have been willing to chance the legal validity of the certificates. In the Canal-st. case the city's contribution would be something like $200,000, and it is generally believed that the Louisiana Improvement Company, which was the lowest bidder, was really the instigator of the property owner's application for an injunction to

secure a ruling of the supreme court to protect itself in the matter of so large an investment of questionable legal value.

The city and the Louisiana Improvement Company have appealed to the supreme court for a rehearing, presenting new arguments of great strength. Just what the outcome will be, of course, cannot now be predicted. Should the decision of the court, which is based on an act of the legislature of 1877, remain, it will mean the temporary defeat of the paving of Canal-st. and a suspension temporarily of all public improvements, the cost of which has not already been provided for in this year's budget of expenditures. Fortunately our legislature convenes early in May next, and there will be no difficulty in securing the repeal of the act of 1877.

Winnipeg's Municipal Asphalt Plant.

The following information regarding the asphalt paving plant belonging to the city of Winnipeg, Man., is for the years previous to 1901, and is given as an addition to the article by Mr. F. E. Puffer, on another page, regarding operations in 1901. City Engineer H. N. Ruttan compiled and first published the figures given:

The first asphalt paving in Winnipeg was laid by contract about 1896. Before the beginning of paving work in 1899, the city bought a stationary asphalt plant erected there by one of the contractors for work previously done. The cost was about $12,000, but this included a 5-ton steam roller. The old roller proved to be light for finishing the asphalt, so a 10-ton roller has been bought. The asphalt plant was moved to a new site, where additions and improvements were made. It has been used since for the work of 1899 and 1900.

The first asphalt came from Ventura, Cal. The next was also a California asphalt, named "Obispo." A portion of the latter was crude, the maltha flux being added in Winnipeg, and a part of it was refined. After this, more Ventura and some Alcatraz asphalt was used. During 1900, Dundonald Trinidad asphalt was used.

The plant includes two asphalt melting tanks, a sand drum, cold and hot sand elevators, millstone for grinding limestone, a storage tank for hot asphalt, storage bins for ground limestone and hot sand, a mixer of seven cubic feet capacity, a 60-horse-power boiler, 30-horse-power engine, air compressor and receiver and various accessories.

The regular force employed to operate the plant numbers an average of twelve men as follows: One superintendent, one engineer, two firemen, two asphalt melters, one asphalt dipper and mixer, one measurer of sand and carbonate of lime, one record keeper, one man for odd jobs and an average of two sand and limestone shovelers. A daily expenditure of $40 covers the cost of operating the plant for a day of nine hours, and for producing material sufficient for 1,000 square yards of 2-inch topping, or 1,500 square yards of 1½-inch binder.

The cost of raw materials in 1900 was as follows: Portland cement in sacks, $3.65 per barrel; asphalt, $36 per short ton; sand, $1.35, and broken stone, $1.10 per cubic yard, both on cars; labor, 17½ to 20 cents, and teams, 40 cents per hour. The plant is located close by a railway line.

The net cost of 45,843 square yards of asphalt laid in 1899 was $2, and the cost of 22,064 square yards laid in 1900 was $2,064 per yard. This was for a 1½-inch Portland cement foundation, a 1½-inch binder and 2-inch wearing surface.

These unit figures of cost include only the expenditures for the material and labor used in paving, besides which there were charges for maintenance of the asphalt plant and for tools.

The asphalt accounts for 1899 and 1900 being as follows:

	Expenditure on account of:			
1899.	Capital	$12,322		
	Tools	262		
	Maintenance	568	$13,152	
1900.	Capital	*733		
	Tools	121		
	Maintenance	**1,048	1,902	
				$15,054

*Chiefly for sand sheds and petroleum residuum tanks.

**Principally for replacing material which was defective when the city bought the plant. It is thought that such heavy items under capital and maintenance as were incurred in 1900 will not be required again, the plant now being in good shape for its present capacity.

Fort Dodge Must Pay for Paving Street Railway Tracks.

The Iowa supreme court rendered a decision Feb. 5 holding that the cost of the paving for the right-of-way of the Ft. Dodge Light and Power Company, on Central-ave., Ft. Dodge, Ia., shall be paid by the city. The suit began in 1899, when Contractor J. W. Campbell of Des Moines, sold his paving certificates to the Iowa National bank of Des Moines. Then the bank endeavored to collect. The light and power company urged that under its street railway charter it was exempted from the tax to be levied for paving, as from other taxes. The bank brought suit for its money and both the city and the company were represented in the case. The company pleaded as its defense for not paying its exemption from taxation and also presented a claim that the paving was not well done and that it should be released from payment on that ground if not the other. Judge Whittaker, before whom the case was first tried, ruled that neither city nor company was compelled to pay for the paving, on the ground that it was defective. The Iowa National bank appealed the case with the result that the light and power company is exempted from taxation and the burden of the debt placed upon the city.

Depression of Tracks in Milwaukee.

Plans for depressing the tracks of the Northwestern railroad in the western part of the city have been submitted to the common council of Milwaukee, Wis., by Charles Poetsch, city engineer.

A satisfactory agreement has been reached between the Northwestern railroad and the mayor and city engineer for the proposed track depression in the Eighteenth ward. When depressed the tracks will be 18 feet below the established grade at North-ave., and 16.27 feet below grade at Folsom-place. From Folsom-place northward the tracks will rise gradually until they reach the present level of the tracks at some point north of the city limits. Room for four tracks will be provided in the cut, the sides of which will be sustained by retaining walls of cement and masonry. The railroad company will construct street viaducts with vitrified brick roadways and cement foot paths on certain streets. The city will vacate certain crossings and change the grade of streets and sidewalks to conform to the surface grades of bridge pavements and bridge sidewalks, and will fill and repave the approaches; also change water pipes and sewers involved outside the right-of-way of the railroad, and pay all damages to abutting property that may be injured. The railroad company will be required to pay for all water pipe and sewer work made necessary within the lines of its right-of-way

Jurisdiction of Village Over Turnpike

A decision has been rendered in the suit of the Fayetteville Railroad and Turnpike Company vs. the Village of Fayetteville, N. Y., and the Suburban Company, by Justice W. S. Andrews, who held that the plaintiff is entitled to judgment enjoining the defendant from interfering with the construction of the turnpike in Genesee-st., in Fayetteville. Damages in the sum of $100 and costs are awarded against the village.

The Suburban Company laid its rails some inches above the grade of the turnpike, and the Turnpike Company raised its road to conform with the grade of the rails. In 1890 the village authorities changed the grade and established a new grade. The question raised in the suit was regarding the power of village authorities over a turnpike corporation whose road passes through the village.

Justice Andrews says:

It seems to me that in fairness and justice to both parties and as an orderly course of procedure, two methods were open to the village. It might, at its own expense, or possibly the expense of the abutting property-owners, acting pursuant to a proper resolution, admitting no notice whatever, have lowered Genesee-st., provided that when the work was completed the highway was left in substantially as good a condition as before. Or, at its option, I think the village having properly adopted a resolution changing the grade of Genesee-st., might upon reasonable notice, require plaintiff to lower its roadbed so as to conform to the grade changed.

In coming to this decision I do not determine the question as to the legality of the various resolutions passed by the village changing or attempting to change the grade of Genesee-st.

Appointment of Water Works Trustees by Judges Invalid in Iowa.

The supreme court of Iowa rendered a decision Feb. 13 holding that the law authorizing the appointment of the board of trustees for water works by the district court judges is unconstitutional, on the grounds that the city as a corporation has all the property rights of a private citizen and the control of the water works must be vested in officers directly responsible to the city. The district court judges are not so responsible, and, furthermore, are not necessarily residents of the city. The decision invalidates the appointment of the board of trustees and returns the control to the city council, but the court suggests that the trustees may be appointed by the mayor or by the governor, though the constitutionality of the latter is questionable.

The decision was rendered in the Sioux City water works case, in which the judges of Woodbury county appointed a local board of water works commissioners. W. S. White, a citizen and taxpayer, questioned the legality of the proceedings and brought an action in quo warranto to test the right of the commissioners so appointed to hold their positions. The district court affirmed the constitutionality of the appointments, whereupon an appeal was taken, with the above results.

Brooklyn's Underground Water Supply Protected.

An opinion in equity has been delivered by Justice Wilmot M. Smith of Patchogue, L. I., which decides that oystermen and riparian owners along the south shore of Long Island are not entitled to injunctions preventing the city from using, to the fullest extent possible, the system of driven wells upon which the water supply of Brooklyn is largely dependent. The decision was rendered in the case of S. Foster Sprague, resident of Freeport. Mr. Sprague, who owns considerable real estate adjoining Freeport creek, sought to have the city restrained from using cer-

tain sections of its conduit line and also the pumping station which he claimed exhausted the fresh water supply of Freeport creek, thereby impairing the navigability of the creek and also rendering it unfit for oyster planting purposes. The action did not involve a direct claim for damages, because the legal principles governing the case were such that no damages could have been demanded or awarded unless a right to the equitable relief afforded by an injunction had been first established. Justice Smith found that the plaintiff had not in any way made good his claim to relief. The navigability of Freeport creek has been maintained unimpaired by the city which, under a law passed in 1898, was compelled to assume certain obligations in this respect. These obligations have been faithfully observed up to the present time and the court holds that there is no ground for believing that they will be disregarded or evaded in the future. Justice Smith is not so definite regarding the argument that the oysterman has been hurt, and he declines to go outside the limits of a particular action in order to establish a general principle. He rules adversely to Mr. Sprague on the grounds that the seeker of the injunction had no vested right to use the bottom of Freeport creek for the development of his bivalves. He was there merely by sufferance of the town of Hempstead, which is the owner of the creek bottom, and, as such, is therefore alone entitled to proceed against the municipality.

Right to Underground Water in California.

Judge Bledsoe handed down a decision, Feb. 5, at San Bernardino, Cal., in the suit of O. W. Lorbeer vs. Richard Gird and others. The plaintiff in 1894 bought a lot of Gird in the Chino ranch, upon which was located a 900-ft. well with water at 20 ft. from the surface. The contract under which the land was sold prevented Lorbeer from developing water on the land in excess of the amount actually required to irrigate the property and for domestic purposes. The evident purpose of this reservation was to preserve the underground waters for various lands owned by Richard Gird. After the contract was entered into, Lorbeer established a 40-H. P. pumping plant in the well and has pumped 100 inches of water which he has sold to other land-holders. The contract under which the land was bought called for payment to be made at certain times, all of which was done until the final payment, when Gird refused to accept the installment or to give a deed to Lorbeer for the property in accordance with the contract. Lorbeer then brought suit to enforce Gird to comply with the specific terms of the agreement. Gird filed a cross-complaint in which he accused Lorbeer with having violated the contract in that he had "developed" water on the property. This raised the question, "Is the act of pumping water from a well developing water?" Judge Bledsoe decided that it was not, and ruled that inasmuch as the well was on the land at the time the contract was entered into the purchaser had a right to use the water therefrom. The plaintiff was given a decree compelling Gird to make a conveyance of the land.

Rehearing Refused in New Orleans Water Case.

The Louisiana supreme court refused a rehearing Feb. 3 to the defendant in the case of the state of Louisiana vs. the New Orleans Water Works. Judge Monroe, who handed down the opinion, first disposes of the contention that undue importance is attributed to the missing rate books which passed from the city to the company with the works, asserting that they are "now almost the sole measure of the obligations of the defendant," and "that the loss of the books is attributed to its gross negligence, the beginnings of which appear to have been coincident, in point of time, with its determination that it would no longer be governed in the matter of its charges by the rates which had been paid to the city, and which were recorded in these books."

The opinion is a lengthy one, and we give a brief summary of it is follows:

1. A private corporation, upon which has been conferred the exclusive privilege of supplying water to a large community for a number of years upon condition that its charges shall not exceed those paid to the municipal corporation which preceded it in control of the works, and which is vested with possession and control of the books of the municipal corporation in which those charges are recorded, and which, therefore, serve as the most authentic evidence of the measure of right and obligation between such private corporation and the community, should preserve such books in safety, and failing satisfactorily to account for them, must be held guilty of negligence, and can derive no advantage from their loss.

2. In a suit by the state to have decreed forfeited the charter of such corporation for the violation of its prohibitions and the non-fulfillment of its obligations, records in suits, litigated between the corporation and members of the community affected, in which such violations and non-fulfillment, quoad the individuals litigating, have been judicially ascertained and determined, are ad-

missible in evidence as against the defendant.

3. So, also, the testimony of a witness, given upon the trial of such a suit, between the corporation and a member of the community affected, may be admitted in evidence, for the purposes of the suit brougt by the state, though the witness, when placed on the stand, is unable to identify the typewritten instrument purporting to contain such testimony, and, by reason of the lapse of years and advancing age, is unable to recall the facts to which he formerly testified, provided; that the instrument is otherwise identified as containing the testimony which had been given by the witness and the witness affirms that such testimony was true when given.

Proposed New Water Supply for St. Louis.

An important proposition such as confronted New York, Boston and other large cities, is now pending in St. Louis. The St. Louis water commission has just filed two reports on the subject of a pure, clear water supply. A majority report, inclining toward a gravitation supply plan, has been submitted by George Y. Wisner of Detroit, Mich., and Benezette Williams of Chicago, and a minority report, recommending filtration of Mississippi river water, by Allen Hazen of New York. To Mr. Hazen's minority report is appended a concurrent report from George W. Fuller, who conducted the filtration experiments in Cincinnati and Louisville.

Prices of Cement in Canada.

In 1901, according to the Galt Reporter, the city of Hamilton made a contract for Portland cement from the United States at $1.60 a barrel, while Galt accepted the lowest Canadian tender of $2.39 a barrel. The Hamilton board of public works has recently received bids for 1902, ranging for Canadian cement from $1.69 to $1.90 a barrel and for United States cement from $1.60 to $1.85. The duty on cement imported into Canada is 43¾ cents a barrel. The prices being for delivery in Hamilton, the net price to the successful bidder is but $1.16¼.

Kansas City Officials Ousted by Court Decision.

A decision handed down by the Missouri supreme court Feb. 19, left Kansas City without five principal charter officers—Comptroller Lund, City Physician Coffin, Clerk Curry, Assessor Yost and City Counsellor Middlebrook, all holdover republicans. The trouble arose about a year ago when the city council refused to confirm the nominations for these officers sent in by Mayor Reed.

After the decision was thoroughly understood the ousted officers left their offices, refusing to assume responsibility for their future conduct and informing their clerks that if they remained at their desks they must do so on their own responsibility.

Burlington, Vt., Public Improvements

The tenth annual report of H. M. McIntosh, city engineer of Burlington, Vt., shows that during 1901 improvements were made as follows:

New macadam roadway, 5,470 feet, making total of 18.435 miles in the city; curbing, 7,483.86 feet, and concrete walks, 7,959.27 feet, making a total length of walks and curbing in the city 23.489 miles; new sewer, 5,316.97 feet, making a total of 24.926 miles.

He refers to the proposition of Dr. W. Seward Webb, to construct a macadam roadway from Burlington to Shelburne, as follows:

The estimated cost of a six-inch macadam roadway, 14 feet wide and 24,600 feet or 4.66 miles, in length is $27,198.27. This includes drainage, but not material change of grade.

To reduce the maximum grade from 10.5 per cent. to 3.5 per cent. near the La-Platte river in Shelburne, also to make some minor changes at Spaulding's, Drew's and Gove's, we estimate the cost to be $14,720.91.

In the town of South Burlington there are 9,480 feet of road. For this the estimated cost is $11,544.92, including drainage. Proposed changes of grade would cost $767.50, making a total cost of $12,312.42 for South Burlington.

In the town of Shelburne there are 15,120 feet of the proposed improvement and the estimated cost of macadam road, as described above, would be $15,655.35, and proposed change of grade would be $13,953.41, thus the total expenditure in Shelburne would be $29,606.

The Bacterial Treatment of Trades' Wastes.

A paper by Mr. W. Naylor before the British Institute of Civil Engineers deals with the general experience already obtained in connection with the treatment of domestic sewage containing a great deal of trades' waste. Mr. Naylor's conclusion is that in only two cases was there difficulty of any but a mechanical nature in treating such sewage and waste bacterially; first, with sewage containing an abundance of trades' waste, consisting largely of starch or starchy products, such as that from breweries, distilleries, bleach works, dye works and calico print works; and secondly, with trades' waste charged with free chlorine.

The self-purification of certain samples of manufacturers' waste on standing suggested the experiment of trying colour-

shop waste from calico print works, brewery waste, etc., on an active bacterial filter. It was found that, although a certain amount of disintegration took place, it was accompanied by souring, and the effluent was unsatisfactory. This souring had been found to be prevented by preliminary contact with putrid sewage or sewage sludge, which probably resulted in the introduction of more active and competitive ferments than the lactic or other acid ferments. The preliminary treatment in the tank therefore, might be termed, not so much septic as anti-souring. A trial was made with starch paste only, and a table of results and methods of examination was given in the paper. This resulted in a trial of liquors from soda and lime kiers in a bleach works, with very satisfactory results. Works on a large scale have been put down at the mill of Messrs. Peel, Tootal & Co., Accrington, and the paper gave the results of working there, with a plan of the tanks. The most noteworthy feature was that the presence of free chlorine before contact with putrid sewage did not interfere with the final effluent. This led to a trial with paper works' waste at the mill of Messrs. Wiggins, Teape & Co., Chorley. Experiments with crude beer have been made, both with and without the anti-souring arrangement, and the results were given, as well as those from an installation on a large scale which followed the treatment of the waste at the brewery of the Hook Norton Brewing company, Banbury.

Franchise for "Waste Boxes" in Louisville Not Properly Granted.

A decision was handed down recently in the injunction suit brought by the city of Louisville, Ky., against Messrs. Grainger, Jefferson and Satterwhite, composing the old board of works and Henry Freking, to whom the board granted the "waste-box" privilege. The suit was filed to prevent the carrying out of this contract on the ground that the board acted beyond its power in awarding such a contract. The decision was handed down by Judge Shackelford Miller of the chancery division, and is a victory throughout for the city, as it sustains the demurrer to every paragraph of the answer. The board awarded a contract to Henry L. Freking to place 250 boxes to be used as receptacles for waste paper, fruit parings and other substances of like character, on the streets in the central portion of the city, the city to receive 30 per cent. of all the profits from the advertisements on the boxes. Judge Miller upholds the contention of City Attorney Stout that the contract is null and void, because the board had, without any authority from the general council, attempted to confer a franchise or privilege upon Contractor Freking in violation of sec. 146 of the constitution, which provides that all franchises or privileges must be granted by the legislative body of the city. The board has conferred upon it the power to construct, repair and keep the streets in order, but it has not power to exercise the great legislative power of granting a franchise or privileges that would exist for a term of years as a servitude upon the public way and inconsistent with its use as a public highway.

Indiana Engineering Society Convention.

The convention of the Indiana Engineering society, which was in session as our February number went to press, was the most successful meeting in its history, both in attendance and interest of program. The committee plan of preparing the program was tried for the first time and proved its value under the careful direction of President W. D. Pence. The plan was made a part of the new constitution which was adopted. The list of papers presented has already appeared in this department.

In the discussion of the papers the need of a central testing bureau for engineering materials was brought out and the facilities of Purdue university were offered under the necessary restrictions, until such a bureau could be established. The discussion of Prof. Newberry's paper on "Portland Cement Concrete" turned largely upon the relative strength of gravel and broken stone concrete and the possibility of securing the complete mixture necessary to warrant the use of the proportions stated in Prof. Newberry's paper to be most economical: 1 cement, 3 sand and 8½ gravel. Prof. Hatt's experiments show that concrete made of 1 cement, 7 gravel is half as strong as concrete made of 1 cement, 2 sand and 5 broken stone, when natural cement is used. There was some objection to considering the two mixtures as in equivalent proportions, in absence of data regarding the proportions of voids. Mr. Kenyon reported the success with the new grand stand for the base ball park at Cincinnati, built in the early summer of 1901 of Portland cement concrete, using stone three-fourths of an inch and less in longest dimension. Rather wet concrete was preferred by the speakers, especially if steel reinforcement was used.

In discussion of the papers on concrete arches by D. B. Luten and J. B. Nelson, the aesthetic features were mainly con-

sidered, the limitations of concrete forms and surfaces and the particular forms of arch curves for beauty being mentioned, the opinions on the latter being various. The question of expansion joints was also considered and Prof. Pence reported that the Illinois Central railroad had found by experience in its iron construction work that concrete walls and arches should have expansion joints each thirty to fifty feet. Thus an arch 100 feet in length from out to out would have two or three lines where the arch would be separated by such joints.

The interesting discussion of the report of the committee on masonry and of the paper on "A Masonry Arch," by F. W. Keller, brought out the limitations of the iron bridges, the fact that the weight and power of traction engines was practically limited by the strength of the bridges over which they must pass. A form for a bill placing the matter of design of bridges in the hands of engineers was presented and referred to the committee for report next year. The questions regarding practice in surveying and recording plats were also referred to a committee with instructions to present a form of law to govern such matters.

The members were the guests of the Indianapolis Water Company on Thursday afternoon, Jan. 30, and after an explanation of the plans for the new 30,000,000-gallon pumping engine under construction and of the air-lift system in use on the company's deep wells, were taken in carriages to inspect the new building for the new engines, the wells, the old pumping station, run by water power, and the site of the recent bridge accident.

The mechanical engineers were represented by a paper on "Power Transmission as a Distinctive Branch of Mechanical Engineering," by E. C. DeWolfe of the Dodge Manufacturing Company, Mishawaka, and one on "The Conversion of Heat into Power in the Steam Engine," by Rollin Defrees of the Atlas Engine Works, Indianapolis. The little tilt in the discussion between the advocates of rope transmission and electrical transmission resulted in a tacit agreement that there were circumstances in which each one would be the more satisfactory and others where local considerations and preferences would decide which should be used. The progress of electrical apparatus toward simplicity was specially emphasized.

Prof. W. E. Goldsborough's illustrated lecture on "Electric Lighting" discussed fully and clearly the various systems and laid down the principles upon which selection should be made for any given case. The advantages of the inclosed arc lamps for low hanging were clearly shown and the place of the incandescent lamp in street lighting was quite clearly defined.

The discussion of the three papers on stream pollution brought out the recurring question of the persecution of Indiana manufacturing industries by farmers and others and Dr. Hurty, the secretary of the state board of health, was present to show by evidence in his possession the small amount of such persecution which actually exists. The effect of the sewage of such cities as Indianapolis upon the streams was clearly stated and a resolution supporting the state board of health in its efforts toward purification and protection of the streams was passed.

The committee on roads and pavements presented a series of topical discussions with a leader for each, which was of much interest to the members. An abstract of the discussion will be given later. The emphasis in the general discussion was laid upon maintenance.

Several of the papers presented will be published in Municipal Engineering. The officers were re-elected, with the addition of J. S. Humphreys of Alexandria to the executive board. W. D. Pence, Lafayette, is president and Charles Carroll Brown, Indianapolis, is secretary. The next meeting will be held in Indianapolis, Jan. 15-17, 1903.

Municipal Reports.

Twenty-Seventh Annual Report, Board of Water Commissioners, Norfolk, Va., Year Ending June 30, 1901. George McIntosh, Pres.; H. L. Smith, Supt.

This report shows that the water works are now in good financial condition, there being a surplus of about $35,000 instead of a call upon the city treasury for about $14,000, as in 1898.

Total receipts during the year have been $154,804, about $15,000 being for machinery and material sold, $13,000 in payment for extensions and $122,000 for water rents. Operating expenses were $31,839, repairs cost $5,978.72, operating filter plant $8,845, other maintenance charges amounted to $21,108, $23,776 went to sinking fund, payments on account of bonds, interest and commissions amounted to $70,310, and the total expenditures were $161,864. The city pays nothing for water furnished and the superintendent asks that as a matter of bookkeeping some sum be fixed upon as the equivalent of the city's use of water, payments to the city promising to be greater than payments therefrom.

Trouble with algae in the clear water basin led to covering it at a cost of $2,027, with entire success in stopping the growth. Investigation developed the fact that electrolysis occurs, but a recommendation that the street railway system be changed to the double trolley was defeated in council. A new 10,000,000-gallon

pump and two 125-horse power boilers were installed during the year. A complete map of the city water lines was prepared during the year. The adoption of meters has been favorably acted upon by a council committee, but the council has not yet passed the ordinance. Careful watching of leakage has postponed the necessity for meters slightly by reducing the proportion of increase in consumption somewhat. Meters or extension of supply are said to be the alternatives. There has been considerable trouble with the 50,000 feet of distributing lines three inches or less in diameter and their displacement by larger pipes is recommended. The daily consumption is 5,307,912 gallons. The filter plant was operated 344 days, the coagulating basin was emptied and cleaned three times, the sand beds in the filter tanks were sterilized with steam and soda ash three times. The marble dust originally placed in the beds having dissolved and passed off, it was replaced by sand. A table shows the pumpage by each engine each month, the coal used, and the ashes removed; the average number of filters used and washed each day for each month, the water used for washing, the net filtration, amount of sulphate of alumina used, per cent. of color and alkalinity removed are given in another table.

Receipts and Expenditures of Ordinary Revenue, 1896-1900. Special Publication No. 8. Statistics Department, City of Boston, Mass. Edward M. Hartwell, Secretary.

The 150 pages of this publication are devoted to detailed comparisons of the totals of expenditures in various departments and offices for the years named. Analyses of estimates and of actual expenditures are given and the tables should be of much use to those whose duty it is to prepare estimates for the ensuing year. The monthly bulletin of the department for November accompanies the special publication.

New Publications.

Engineering Periodicals and the Card Index. The advantages of systematic reading of the current engineering literature, with an argument for the individual card index and its application to engineering. An address before the students of the Society of Mechanical Engineers, Sibley College of Mechanical Engineering, Cornell University, Ithaca, N. Y. By H. Wade Hibbard, Professor of Mechanical Engineering of Railways.

The above quite fully describes the pamphlet, which is a very valuable discussion of the subject and guide to the reading of engineering literature and the operation of a card index, which every engineer will find of the greatest value as a time saver if he will spend the time necessary to keep it up.

Municipal Affairs. General information of interest to property-owners; the courts, board of public improvements, municipal assembly, real estate, building news and general intelligence. Weekly, $1 per annum. Property-owners' Protective and Information Bureau. St. Louis, Mo.

This is the latest periodical devoted to local improvements and their effects upon the property-owners. It is more in the nature of a newspaper than others, and has the critical attitude of the property-owner, who is trying to protect his property from assessments for improvements rather than the Merchants' Association, Board of Trade or Commercial Club, which is trying to reform abuses that public improvements may be extended properly and economically, but extensively enough to develop the city as rapidly as it can be done.

Lighting by Acetylene; Generators, Burners and Electric Furnaces. By William E. Gibbs, M. E. 161 pp., cloth, $1.50. D. Van Nostrand Company, New York City.

This book, first written in 1898, is kept up to date by new editions and is an excellent epitome of the progress in the art of lighting by acetylene in small plants and individual lamps. It gives a history of the gas, an analysis of the various dangers accompanying its use, real or fancied, and the methods which have been devised for removing them. Two chapters are devoted to the manufacture of calcium carbide and nearly a hundred pages to the generation of acetylene, the principles of the various methods being stated under two main classes, the wet and the dry process, and many of the most successful generators being shown by diagrams and short descriptions. The effects of impurities in carbide and in acetylene and their sources are described, with instructions how to avoid them. Acetylene lamps and burners each have a chapter. The author has made many experiments upon apparatus for the generation of acetylene and about twenty pages are occupied by a description of them. The requirements of the New York board of fire underwriters for the installation of acetylene generators are given in full. The book closes with a list of the United States patents upon carbide and electric furnaces and acetylene generators, which is greatly extended in each new edition, as the activity of inventors in this field has been great during the last five or six years.

Economics of Road Construction. By Halbert Powers Gillette. 41 pp. cloth, $1. The Engineering News Publishing Company, New York City.

This book should be very valuable as a stimulator of thought regarding the terms of specifications for road construction. It calls attention to some of the venerable errors which have been handed down from one essay or book to another. These errors are both in facts and in principles. Mr. Gillette furnishes data for at least a partial correction of some of the mis-statements of the facts, and the theories which he advances are at least eye-openers and should have the effect of inducing more careful consideration of the principles of road building. He is almost too forceful a writer for a scientific work and makes some strong statements of rules and deductions from experiments, (for all of which the data are not presented), which are seen later to be based upon a rather limited experience and must, therefore, not be accepted any more blindly than the most ancient dicta from which he removes the foundation. Quite a number of summaries of notebook records of observations of cost of doing work are presented which will be valuable for any one keeping in mind the class of work on which they were obtained. The author follows Professor Baker and some other engineers who have apparently forgotten their Latin in using such expressions as "this data has," etc. A breezy book like this is occasionally refreshing, though the author does sometimes allow his zeal to run away with his discretion. The doubt which such a style of writing throws upon a technical work is not deserved in this case, the only caution to be observed being that mentioned above—not to apply such statements as are not fully supported by the data given to conditions differing greatly from those for which they were deduced.

A Treatise on Arches, designed for the use of engineers and students in technical schools. By Malverd A. Howe, M. Am. Soc. C. E., Professor of Civil Engineering, Rose Polytechnic Institute, 371 pp. and 73 illustrations, cloth $4. John Wiley & Sons, New York City.

Prof. Howe has produced a book which should serve as a great convenience for students of the arch form and for those who design structures using it. The theory of the elastic arch is developed and the resulting formulas are simplified for practical use. Sets of general formulas are given in their strict form and in their summation form, the slight errors of the latter under ordinary conditions being shown by comparisons of results, thus showing the safety of the simpler formula. Vertical and horizontal loading, changes in temperature and in form are considered. Alexander and Thomson's method for segmental masonry arches is given. The collection of formulae in chapter 2, the tables of values for insertion for given dimensions, as well as the full statement at the beginning of the nomenclature used in the formulae make the book most convenient for the busy engineer who needs to use it with the least possible expenditure of time.

Handbook on Sanitation: A manual of theoretical and practical sanitation for students and physicians, for health, sanitary, tenement house, plumbing, factory, food, and other inspectors, as well as for candidates for all municipal sanitary positions. By George M. Price, M. D., Medical Sanitary Inspector, Department of Health, New York City. 329 pp., 31 figures. Cloth, $1.50. John Wiley & Sons, New York.

The book seems to have been specially prepared for the last class of students described in its title, particularly those looking for positions in New York City. Many of the various chapters in the second part are simply introductions to the sections of the sanitary laws and regulations of the city of New York, to full extracts from which 80 pages of the fourth part are devoted. The third part gives hints and suggestions and memoranda and tables which should be of some value to those wishing to know how to prepare for the civil service examinations. The first part, about 100 pages, discusses very briefly the theoretical side of the science of sanitation, and follows standard methods in the bare outline given of ventilation, heating, water supply and house construction. The authorities followed in the two chapters on sewage disposal are quite antiquated, the results of modern practice and experience being ignored completely. The three chapters on plumbing are more within the field with which the author is familiar and, so far as they go, give the standards of New York practice.

While the book is made for New York City's conditions and laws, and those of most other cities differ somewhat from them, the book will be found very useful to sanitarians outside of the city as well as within, as a statement of the methods of procedure in that city, and a guide in formulating regulations for other cities. It should not be followed too slavishly,

for differences in conditions, as well as some differences in opinion upon details, will call for some appreciable modifications of such details.

Second Report on the Highways of Maryland, with Especial Reference to the Operations of the Highway Division During 1900 and 1901. By Harry Fielding Reid and A. N. Johnson. Maryland Geological Survey. William Bullock Clark, State Geologist, Baltimore, Md.

One of the duties of the state geological survey is to make surveys and plans for roads. Reports have been made on about twenty-five roads at a cost for surveys, plans and estimates of $20 to $35 a mile. Nearly $600,000 a year is spent on the roads of the state for bridges, repairs, permanent improvements and new roads, of which less than $70,000 is for the last two items. Contracts and specifications for some new roads are given, showing excellent construction. Detailed reports of expenditures on roads in Baltimore county are given in the report of the county road engineer. The county is divided into fifteen districts, each under two or three commissioners, and the total expenditure for the year 1901 was $149,227. System is being developed and improvement in conditions is in sight. An important part of the work of the geological survey is the testing of materials. This branch of its activity will be considered more in detail later.

A Treatise on Surveying, Comprising the Theory and Practice. By William M. Gillespie, LL. D., formerly Professor of Civil Engineering in Union College. Revised and enlarged by Cady Staley, Ph. D., President of Case School of Applied Science. Part I, Land Surveying and Direct Leveling. 428 pp. and Traverse and Logarithmic Tables. $3.50. Part II, Higher Surveying. 467 pp., $2.50. D. Appleton & Co., New York.

Gillespie's "Land Surveying" was first printed in 1851 for the use of his classes and soon became the standard authority upon its subject. The second volume was partly written by Prof. Gillespie and completed and published by Prof. Staley in 1870. The two volumes were revised and combined into one in 1887 and they were again enlarged and issued separately in 1896, since which time several new and revised editions have been published, thus including the results of the latest advances in methods.

The first volume has long been and still is the vade mecum of the land surveyor, giving, as it does, the details of adjustment and use of instruments and solutions of the various classes of problems arising in the everyday work of the surveyor, including the instructions to United States land surveyors and the principles upon which re-surveys should be made. A full chapter upon leveling is included. Appendices give a synopsis of plane trigonometry, transversals, harmonic division and many problems in field work. An analytical table of contents makes any subject easy to find. Full traverse tables and tables of chords, of logarithms of numbers and trigonometric functions, of natural trigonometric functions, of refraction in declination, and a stadia table complete the book and make it convenient for field use. Complaint is often made of the uselessness of 6-place tables as compared with 5-place on the one hand and 7-place on the other, but they seem to strike the medium between lack of accuracy and bulk of tables which is most acceptable to the field engineer and for his purposes their use is all but universal.

In the second volume the chapters on Geodesy, Field Astronomy, Trigonometric Leveling and Precise Leveling were written by an assistant upon the United States Court and Geodetic Survey, that upon Topography by Prof. Neff, that on Mine Surveying by a mining engineer and that on City Surveying by a city engineer. There are also chapters on Triangular Surveying, Barometic Leveling and Maritime or Hydrographic Surveying. The line between the details and extent of discussion required by the expert on the one hand and the general view of the subject of little use to any one is very carefully drawn and the result is a valuable book for use in college classes and by the young engineer desiring to post himself upon the methods of the higher grades of surveying work which have been found most satisfactory by those who have developed or used them in actual practice.

Costs accounts, with numerous formal rulings and full explanations showing method of ascertaining cost in a factory where a variety of articles are made, mostly passing through several processes in the course of manufacture, and detailing minutely how the ordinanry expense accounts of any business are utilized in arriving at and verifying cost of production. By C. A. Millener, LL. B., LL. M., for many years auditor of the Rathbun Company's industrials and railways. Deseronto, Ont. Edited by R. F. Spence, accountant, Toronto: The Hunter, Rose Company, Limited.

The book is a valuable guide to the manufacturer in establishing accounts showing the costs of the various operations necessary in preparing his product for the market. It develops the principles upon which the system of accounts should be based and exemplifies their use in detail in the manufacture of Portland cement. The book will be of especial interest to many of our readers on account of the fact that this material is chosen as the example, and that the long connection of the author with the oldest and

fargest factories in Canada makes his treatment of the subject of special practical value.

After the first general chapter upon principles, three chapters are devoted to the cement factory, one analyzing the process of manufacture and the other two developing the forms of accounts in the operating ledger and the methods of using them. Other chapters discuss the forms of ledgers for keeping track of stores, stock, wages and salaries. Variations of forms for several industries are discussed in the eighth chapter and forms of cost statement for flour mills, sash and door factories, clay works, iron and coal mining, coke ovens, iron furnaces and foundries are given in detail. As all of these industries are conducted under the same management for which the author is auditor, he is well fitted by experience to recommend such forms, and those interested in other industries can readily prepare their own forms after a careful study of the principles upon which they should be based, as developed in this book.

Technical Meetings.

The February meeting of the New England Water Works was held in Boston Feb. 12. A paper on "The Marlborough Water Works" was presented by George A. Stacy, superintendent of Marlborough, Mass., water works, and on "How to obtain the Best Results in Small Pumping Stations," by Harry F. Gibbs of Natick, Mass. The committee on "Standard Specifications for Cast Iron Pipe," submitted a report. Frank C. Merrill president, Somerville, Mass.; Willard Kent, secretary, Narragansett Pier, R. I.

A good roads convention will be held in Charlottesville, Va., March 19, 20 and 21.

At the recent meeting of the Engineers' club in Minneapolis, Minn., Wilbert F. Dealing read a paper on "Sidewalk Construction."

The Wisconsin Gas Association held its annual meeting at Madison, Wis., Feb. 12 and 13.

The eighteenth annual meeting of the Connecticut Society of Civil Engineers was held at Hartford, Conn., Feb. 11. A paper on "The Metric System—Its Application as Compared with English Units for Linear Measurements and Their Sub-Division," was read by George M. Bond. Officers were elected as follows: President, Clarence B. Vorce, Hartford; first vice-president, Frederick L. Ford, Hartford; second vice-president, John K. Punderford, New Haven; secretary and treasurer, George K. Crandall, New London; directors, Charles M. Jarvis, New Britain; Charles H. Bruce, Hartford; Henry J. Kellogg, New Haven; Robert A. Cairns, Waterbury.

The Mayors' Association of Connecticut held a meeting at Hartford, Conn., Jan. 29. The next meeting will be held at the office of Mayor Cummings in Stamford, Conn., in June.

The League of Ohio Muncipalities elected officers Feb. 5 as follows: President, C. W. Linkhart, Xenia; vice-president: L. G. Silbaugh, Lancaster; treasurer, J. L. Orbiston, Carthage. The next meeting will be held at Hamilton.

The Illinois Society of Engineers and Surveyors at its annual meeting elected H. G. Paddock, Moline, president; E. E. R. Tratman, Chicago, vice-president; H. A. Stevens, Joliet, and M. S. Ketchum, Champaign, trustees, and A. L. Kuehn, Urbana, executive secretary. The next meeting will be held at Aurora.

The meeting of the Iowa Engineering Society of Cedar Rapids was largely devoted to pipe laying, railroad work and surveying problems, there being discussions also upon sewerage and concrete. The officers elected were: M. L. Newton, Waterloo, president; G. Davis, Cedar Rapids, vice-president; T. R. Warriner, Cedar Rapids, secretary-treasurer; A. V. Sims, Iowa City, and C. R. Allen, Ottumwa, directors. The next meeting will be held at Ames.

How to Lay Bituminous Macadam.

From a paper before the Boston Society of Civil Engineers by Fred J. Warren we take the following clear statement of the method of laying bituminous macadam pavement followed by him:

The ordinary method employed in its construction is to assume that a natural foundation, thoroughly rolled with a heavy road roller, furnishes a solid subbase; that a solid base of four inches of 2 to 2½-inch stone will, after thorough compression with a 15 to 20 ton roller, provide an ideal foundation for a waterproof surface, and will provide drainage to moisture accumulating from the surrounding ground. If more drainage is necessary, drains rather than extra foundations are advisable. The stone is better if very hard, but this is not so important in the foundation as in the top.

On top of the stone foundation is spread or sprinkled a coating of specially prepared thin bituminous cement which enters the minute crevices of the surface of the stone and permits the stone in the foundation being firmly held together with the waterproof cement, which is afterward freely used over the surface of the foundation. This waterproof cement is thus enabled to grip onto the stone permanently and, being of a hard , pitchy nature of a grade of flexibility that will bind the surface of the foundation firmly in place, it makes the foundation itself rigid before the wearing surface is rolled in.

On top of the foundation thus prepared is spread a layer of the wearing mixture which should have a thickness of about two inches after its maximum compression. This mixture is a carefully prepared combination of 1-nch to 2-nch stone, having voids filled with receding sizes to a dust or powder of stone. Some sand may be used to aid in filling voids when necessary.

The mineral or stone part is dried and heated in a modern dryer and is then separated by screening with rotary screen into its sizes varying from fine dust, which is less than 1-200 of an inch in diameter, to the largest size used. The several sizes of stone are then mixed in predetermined proportions, so as to reduce the voids to about 10 per cent. in a modern "twin pug" mixer, and the hot bituminous cement is added in the mixer in sufficient quantity to not only coat every particle and fill all of the remaining voids, but with enough surplus to furnish to the mixture after compression a rubbery and slightly flexible condition.

The mixer makes seventy-five revolutions per minute, and every particle of mineral is coated in about 15 seconds, but the mixing is continued about two minutes to provide absolute uniformity of distribution of bitumen and mineral. The whole is dumped by gravity into wagons and hauled to the street where it is spread in the same manner as an asphalt pavement. It is then rolled with a 15 to 20 ton road roller which gives many times as much compression to the inch run as the ordinary asphalt roller.

After a thorough and continuous rolling there is a little honeycombed appearance to the surface where coated particles of stone come together, but the body of the mixture on being broken shows denser under the magnifying glass than any bituminous wearing surface that has heretofore been used.

Good rolling is an essential feature, as it assists to place the particles where they belong, and continued rolling forces out the minute air bubbles and forces the surplus bitumen into the fine voids, leaving the body of the surface so dense that it cannot be rutted or displaced by traffic. It also adds to the life of the bituminous cement by protecting it from the action of exposure to the elements in minute semi-detached particles. The rolling should commence as soon as the surface is spread, and it is advisable that one heavy roller should not be required to do more than 1,000 square yards of surface per day.

On top of the surface thus made, partly to heal and seal the surface from attack and partly to hold and help make a practical wearing surface, there is poured and rubbed into it all of the quick drying bituminous cement that it will take. This leaves the surface as sticky as if freshly painted.

On this surface is spread a coat of fine stone chips which adhere to the bitumen on the bottom and present a rough, gritty surface to travel. The rolling of these rough chips into the surface has the effect of putting the pavement under greater pressure, and forces as much stone into the surface as it can possibly receive, thus making it more gritty and suitable for travel.

The Asphalt Situation.

The plans for reorganization of the National Asphalt Company are in the formative stage. One proposition is to form three companies, one each for the Atlantic, the Pacific and the central states, and another for the merging of all the sixty-nine separate subordinate companies into one. The receivers are said to have asked for the resignations of the officers and directors of the National and American Companies that the reorganization may be proceeded with without waiting for the annual meetings. These changes so far do not affect the direct management of the subsidiary companies.

Henry Spinks of Newport, Ky., has filed a bill to have the appointment of receivers reopened, claiming fraud and collusion and a plan to wreck the American Company for the benefit of the stockholders of the National Company.

Meanwhile there are reports of the purchase of new asphalt deposits by the Warner-Quinlan asphalt syndicate, one in Tamaulipas, Mexico, the Lopez estate, which has been in litigation for three years and has just been sold. It is also said that the superior court at Cumano, Venezuela, confirming the decision of the lower court, has awarded the possession of Lake Felicidad to the Warner-Quinlan Company pending the decision as to the matter of title, now on trial in the Federal Court of Caracas.

Battle Creek, Mich., Water Works.

The superintendent of water works at Battle Creek, Mich., W. W. Brigden, issues a sheet giving comparisons of the operation of the works for the four years —1898, 1899, 1900 and 1901. During that time new constructions amounting to nearly $40,000 have been put in, two-thirds of it for mains. The number of taps has increased from 2,124 to 2,624, of meters from 1,515 to 2,125 and percentage of taps metered from 71 to 81. The average receipts per 1,000 gallons for metered water are 11.7 cents in 1901, for all water pumped 4.8 cents and for unmetered water 3.3 cents, all of the waste being included in the unmetered water. The per capita consumption for each of the four years is 43, 48, 55 and 68 gallons and per tap is 345, 371, 421 and 520, showing a constant increase notwithstanding the extension of the meter system. The receipts per tap have increased from $8.14 in 1898 to $9.11 in 1901, practically the same percentage of increase as in number of meters.

Personal Notes.

Hon. Thomas S. Fry, mayor of Mobile, Ala., died Feb. 6.

Hon. George Wilson, ex-mayor of Pittsburg, Pa., died Feb. 5.

Hon. T. W. Hugo was re-elected mayor Feb. 4 at Duluth, Minn.

F. G. Moreland has been elected city engineer at Knoxville, Tenn.

Henry MacAuley was elected mayor of Dawson, Y. T., Alaska, Feb. 6.

Richard A. Jones has been appointed superintendent of streets at Waltham, Mass.

G. L. Parkhill has been re-elected superintendent of water works at Redwood Falls, Minn.

T. F. Matthews and W. H. Hill were elected water commissioners, Feb. 3, at Petersborough, Ont.

Winchester H. Adams, city clerk at New Castle, Ind., died Feb. 5 of heart trouble, aged forty-five years.

Hon. James S. Foreman, ex-mayor of Williamsport, Pa., died Feb. 9 of paralysis, aged sixty years.

S. E. Folk has been appointed superintendent of the electric light and water works plant at Bryan, O.

E. H. McCullough has been appointed city engineer to succeed Park A. Dallas, resigned, at Greenville, S. C.

Robert B. Ingram has resigned as engineer in charge of the high-service water supply at Jersey City, N. J.

Robert Lockhart has been appointed superintendent of the water bureau at Albany, N. Y., to succeed George I. Bailey.

H. B. Grant, C. E., Laurel, Miss., died Feb. 8, aged sixty-five years. Mr. Grant was the engineer of the new St. Louis bridge.

George F. Owens has been appointed superintendent of streets and William F. Hodges superintendent of water works at North Adams, Mass.

Robert Bryson has been appointed a member of the board of public safety at Indianapolis, Ind., to succeed Captain W. E. English, resigned.

Stratton S. Knox was re-elected president of the Board of Public Works, Feb. 3, at Cortland, N. Y. W. E. Stratton was reappointed street superintendent.

George R. Olney has been appointed chief engineer of the bureau of highways of the Borough of Manhattan, New York, to succeed Andrew Foye, resigned.

James H. Kerr has been appointed city clerk at Alpena, Mich., to fill the unexpired term, ending March 31, of Fred W. Hazen, who disappeared from the city Jan. 9.

A. B. Stevens was confirmed as city engineer, Charles H. Christopher as superintendent of water works, and A. C. Smith as street commissioner, Feb. 17, at Jackson, Mich.

Michael J. O'Donnell has been re-appointed member of the board of water commissioners and Henry Weiler, sr., appointed to succeed Charles E. Hequembourg as a member, at Dunkirk, N. Y.

Mayor George Grime of Fall River, Mass., has appointed as his secretary Mr. John Crowther, a man with fifteen years' newspaper experience in that city and a former member of the board of aldermen.

Herman Silver, James C. Kays, Charles H. Toll, John M. Elliott, Louis A. Grant, Francis H. King and Maj. H. F. Grant were appointed water commissioners Feb. 5, at Los Angeles, Cal., to serve until December, 1902.

Willis F. Brown and Harley J. Hill, civil and consulting engineers, have formed a partnership, known as Brown & Hill, and succeeding to the business of Willis F. Brown, with offices at 55 Law Building, Toledo, O.

The Hon. Charles Shilling, mayor of Decatur, Ill., was acquitted Feb. 20 of the charge of malfeasance in office. He was charged with permitting gambling rooms to run, allowing Sunday liquor selling, making illegal slot machine contracts and allowing immoral shows to give exhibitions.

John Brunner, M. Am. Soc. C. E., has resigned his position as superintendent of the bureau of engineering and construction, department of public works, Pittsburg, Pa., to accept that of assistant general superintendent of the structural department of the Illinois Steel Company, Chicago, Ill.

Owen W. Pfouts, city engineer of Alliance, O., died at his home in Canton, O., Feb. 2, aged thirty-five years. Mr. Pfouts had served as city engineer at Alliance since 1896 and it was largely due to his efforts that a city sewage disposal system was established, the water works purchased and various other improvements made.

Mayors have been elected as follows: P. M. Costello, Scranton, Pa.; Charles H. Price, Wilkesbarre, Pa.; Edward Yeager, Reading, Pa.; Vance C. McCormick, Harrisburg, Pa.; Chester Cummings, Lancaster, Pa.; Howard H. Houston, Chester, Pa.; S. M. Hoyer, Altoona, Pa.; John Pedry, Johnstown, Pa.; Abram Hess, Lebanon, Pa.; Horace Lehr, Easton, Pa.; M. B. Cobson, York, Pa.; John F. Leadlein, Williamsport, Pa.; George H. Potter, Bradford, Pa.; William Hardwick, Erie, Pa.

MACHINERY AND TRADE.

Modern Machinery in Sewer Building.

On the Cornell-ave. sewer in Chicago a modern labor-saving device is in use in the form of a machine for handling the dirt from the sewer trench. It is the Potter trench machine, consisting of a metal track 272 feet long, running above the sewer and supported on a framework spanning the trench and movable along another track laid along the edge of the excavation; a car running on the track, carrying two metal buckets; the car and buckets being operated by a cable driven by a 30-horse power engine. The machine was built in Indianapolis and cost the city of Chicago $4,700. It takes the dirt from the portion of the trench under excavation and carries and dumps on the completed sewer at the other end of the trestle. Two buckets are lifted at a time, carried to the dump, emptied and returned empty, two other filled buckets taking their places. The machine will handle 480 yards of earth a day. The accompanying photograph shows one of the machines at work. A corner of the Chicago Beach hotel shows in the picture.

POTTER SEWER TRENCHING MACHINE.

The bents in the trestle are sixteen feet apart, and trestle and track and carriage are readily taken apart for transportation from place to place. Either one or two buckets can be carried, no change in the machine being necessary. The combination of drums in the hoist is arranged to require a minimum of power, and the drums are large enough to reduce the cable wear to the least possible extent. A round trip of the buckets can easily be made in one minute. The machine shown in the photograph is of special size, the track being twenty-three-feet gauge and the trench twenty feet three inches wide.

The Oldest Plow Makers in America.

The manufacture of the Wiard plow began in the state of New York in 1804. For nearly a century members of that family have continued its manufacture. In 1876 the Wiard Plow Company was incorporated at Batavia, N. Y., and it still continues to manufacture the Wiard plow and other implements. It would be interesting to trace the evolution of the Wiard plow from the time of its first manufacture to the present. The factory is at Batavia, N. Y., but the sale of the plow is so large that transfer depots have been established at Boston, Detroit, Philadelphia and Pittsburg for the convenience of customers. The company manufactures a special plow for heavy excavating and all kinds of contractor's work which is of special interest to builders and users of road machines and all engaged in moving earth where great strength and capacity for excavating are required.

Imported Asphalt Mastic.

Gabriel & Schall, 205 Pearl-st., New York, are the sole importers for the United States and Canada of the

"Genuine Brunswick" Asphalt Mastic manufactured by the Vorwohle Asphalt Company of Eschershausen, Germany, Messrs. Rehder & Co. of London, England, proprietors. The worth and popularity of the Brunswick is attested by its large sale in America and the fact that it has been used and tested by the United States government and many of the largest contractors in this country. Like all good materials it has its imitations and in order to protect the trade and parties using such materials the manufacturers put out the "Brunswick" in cylindrical cakes and on the end of each cake is the trade mark, a circle containing the words "Brunswick, G. & S., Germany." Messrs. Gabriel & Schall have sent out a miniature fac simile of these cakes, which makes a neat and serviceable paper weight. For over twenty years this firm has been the sole importer of the "Brunswick" and has succeeded in establishing for it an excellent reputation with the trade.

Power Brick Machinery.

The Henry Martin Brick Machine Manufacturing Company of Lancaster, Pa., has issued its catalogue, No. 60, of soft mud, wire cut and dry press brick machinery and brick yard supplies. The works were established in 1858 and the present company was incorporated in 1887. The successful use of the machinery for nearly fifty years is evidence of its thorough construction, and the variety of designs and machines shown in the catalogue shows that the company proposes to supply all the needs of the trade in its lines, as new and improved methods of handling material develop. Copies of the catalogue will be sent to any interested persons.

A Successful Plaster Mixer.

The thorough mixing of wall plaster is so essential to good work in the builders' sphere that in order to obtain reliable and uniform results mechanical means of blending have been almost a necessity. One of the most popular and practical machines on the market is the lightning plaster mixer, made by the J. H. Day Company of Cincinnati, which is said to perform both excellent and rapid work. This firm also makes a very superior sand dryer, which is justly popular in the building trade. Their advertisement appears in this issue.

Trade Publications.

The good points of the many products of the Buffalo Forge Company, Buffalo, N. Y., are set forth in a series of well written, neatly illustrated and tastefully printed brochures of convenient size for filing and reference.

Dunn Manufacturing Company of Cleveland, O., are sending out catalogue "D," for 1902, which describes the Extensible Trench Brace or Ditch Jack for bracing sheeting in trenches.

The National Meter Company has issued a catalogue describing and illustrating the Nash gas and gasoline engines.

"What! Only twenty-seven Revolutions?" is the striking sentence that adorns the first cover page of a pamphlet issued by F. L. Smidth & Co., 66 Maiden Lane, New York. The publication is to advertise the Davidsen Patent Tube mills, "Dana" pebbles, Smidth Ballmill and the Automatic Ballmill Feeder, all sold by this firm. A list of cement mills using these standard machines is included in the pamphlet.

The Lane & Bodley Company, Cincinnati, O., issue several neat, small catalogues containing data concerning the Lane & Bodley Company's Columbia Corliss Engines, Air and Gas Compressors, and other machinery manufactured by the firm.

Taplin, Rice & Co., of Akron, O., have sent out an attractive catalogue of clay-working machinery for sewer-pipe manufacturers and potters' use.

The Bullock Electric Manufacturing Company, Cincinnati, O., issue a series of catalogues showing the advantage of the Bullock electric apparatus of all kinds.

Bulletins No. W-47, W-48 and W-51 are sent out by the Wagner Electric Manufacturing company of St. Louis to advertise the switchboards and other electrical apparatus manufactured by the firm.

"Valves" is the subject treated by the 1902 catalogue published by the Foster Engineering company of Newark, N. J. The book contains many points of interest to engineers and a list of the products of the company.

A very attractive catalogue is that issued by the Henry Martin Brick Machine Company of Lancaster, Pa. The Martin machinery is illustrated and described.

The Wiard Plow company of Batavia, N. Y., has issued its twenty-seventh annual catalogue. The frontispiece is a photograph of George Wiard, president and general manager of the company. The various kinds of implements made by the firm are fully described

The Stillwell-Bierce & Smith-Vaile Co., Dayton, O., issue two new catalogues. No. 40 of high grade power pumping machinery and No. 41 of special machinery for heating and pumping feed water for steam boilers.

Calendars have been received from the following sources during the month: Vulcanite Portland Cement Company, Real Estate Trust building, Philadelphia, Pa.; Reese-Hammond Fire Brick Company, Bolivar, Pa.; Ft. Wayne Electric Works, Ft. Wayne, Ind.; J. S. Schirm, San Diego, Cal.

Trade Notes.

ASPHALT.

The headquarters of the Barber Asphalt Paving Company for northern Indiana have been located in the Claypool building, Indianapolis.

Kansas City, Mo.—The Parker-Washington Company desires to purchase a 10 or 12-ton asphalt steam roller, with steam steering gear. Address Parker-Washington Company.

The Warner-Quinlan Asphalt Company has secured, through the sale of the Lopez estate in the state of Tamaulipas, Mexico, the asphalt deposits on the eastern coast.

BRICK.

The New Brick and Paving Company, Syracuse, N. Y., elected officers, Feb. 3, as follows: President, H. J. Baldwin; secretary, E. M. Klock; tellers, J. L. Breed and L. A. Worden.

The Union Fire Brick and Tile Company, which has been operating the works of the Union Fire Clay and Stone Company, one mile north of Lisbon, O., has sold its interest to Pittsburg capitalists. The Coleman works, at Lisbon, and the Furnace Fire Clay Company's works at Salineville, have also been sold to the Pittsburg parties and it is understood that the three concerns will be transferred to a syndicate which will operate fifteen or twenty similar works in eastern Ohio.

The W. S. Dickey Clay Manufacturing Company contemplates building a $200,000 plant in southeastern Kansas within the coming year for the manufacture of artificial paving brick, building brick, hollow brick for partition walls, farmers' drain tiles and roofing tiles. The company has options on a dozen sites and is now making tests. W. S. Dickey says the plant will be located somewhere between Iola and the south line of Kansas.

The city engineer's department, Baltimore, Md., has awarded contracts for artificial paving blocks and sewer pipe for 1902 to William Wirt Clarke & Son.

The Denny Clay Company, Seattle, Wash., secured the contract for furnishing 100,000 vitrified brick to be used in paving the streets of Manila, P. I.

The Troy Paving Brick Company, Troy, N. Y., is being organized to manufacture paving brick. A large plant will be erected at Canal and Fifth-aves. A. H. Davitt is the principal stockholder and promoter.

The city of Wampum, Pa., has donated 12 acres of land to the American Cement Tile Manufacturing Company, a large tile manufacturing plant will be located there. The manufacturers of the company are: President, Capt. M. S. Marquis, New Castle, Pa.; treasurer, Matthew Gunton, Beaver, Pa.; Joseph S. Kauffman, New Castle, Pa.; Joseph Freund, Pittsburg, Pa.

The American Chemical Stone Company of Holyoke, Mass., has purchased the brick plant of George W. Richards of South Hadley Falls.

D. J. Curtis & Son, with office at 77 Everett-st., Springfield, Mass., have burned a kiln of vitrified brick with the result that the manufactures feel that their experiments have proven a success, and three more kilns will be burned at once.

CEMENT.

According to press reports two cement plants will be built at Wharton, Ontario, Canada.

The Colton Cement Works, Colton, Cal., which have been closed owing to the lack of spar which is shipped from Arizona, resumed operations Jan. 24.

The directors of the Clare Portland Cement Company, Clare, Mich., have announced that the construction of the buildings for the proposed plant five miles north of Clare, will be commenced as soon as the frost leaves the ground.

Fire destroyed a large part of the plant of the Empire Portland Cement Company, at Warner, N. Y., Feb. 5, entailing a loss to buildings and machinery of about $60,000. The works will be rebuilt.

The Southern States Portland Cement Company, Atlanta, Ga., is being organized and a large plant will be built at Rockmart. B. T. Cowham of the Peninsular Portland Cement Company will be president of the new company.

The F. O. Norton Cement Company of 92 Broadway, New York, expects within a few days to go out of business, having agreed to join interest with others in the formation of a new company to be known as the Consolidated Rosendale Cement Company.

The St. Louis Portland Cement Company will be ready to manufacture cement by July 1, 1902. The company's brand is known as the "Red Ring Brand." E. E. Paramore is the president of the company.

The Midland Portland Cement Company, Indianapolis, Ind., recorded, Feb. 18, the deeds and mortgages necessary for commencing the erection of a Portland cement plant about one mile south of Bedford, Ind.

The Marksboro Portland Cement Company, Marksboro, N. J., has elected officers as follows: President H. F. H. Snyder of Paterson; Vice-President, Philip Scanton, Newark; Treasurer, John Brooks, Boston. The company's new buildings are about completed.

The citizens of Bessemer, Ala., raised a bonus for a $20,000 cement and fertilizer plant. The money will be invested in a building site for the plant, which will be deeded to the company when the proposed works are completed.

The Standard Portland Cement Company, San Francisco, Cal., has been incorporated by W. J. Dingee, F. W. Henshaw, W. T. Henshaw, E. J. McCutchen and F. C. Havens.

The Peninsular Portland Cement Company, Jackson, Mich., has re-elected officers as follows: President W. R. Reynolds, Jackson; Vice-President, C. A. Newcomb, Detroit; Secretary, W. T. Cowham, Jackson; Treasurer, N. S. Potter, Jackson. Plans will be prepared for doubling the present output of the plant at Cement City, Mich.

The American Cement Tile Company, with offices and works at the Pennsylvania Railroad and Linden-ave., Pittsburg, Pa., has been organized and a new manufacturing plant will be erected at Wampum, Pa. New Castle capital is largely interested.

The Lakefield Portland Cement Company, Lakefield, Ont., Canada, has opened its works. The officers of the company are: President, J. M. Kilbourn; vice-presidents, R. P. Butchart and W. H. Bradenver; directors, H. B. Smith, F. H. Kilbourn of Owen Sound, Ont.

The German-American Cement Works, making "Owlcement" near LaSalle, Ill., will enlarge its plant.

The cement construction firms of McLaughlin & Son and the Mateer Bros. of Kankakee, Ill., have consolidated under the name of the McLaughlin-Mateer Construction Company.

The J. H. Blauvelt company, Arlington, N. J., has been incorporated to manufacture cement, etc., by Philand H. Johnson, Peter T. Danels and Otto J. Strasser.

H. L. Bailey, the cement tester for the Chicago board of local improvements, reports that he tested during 1901 101,532 barrels of cement, all American Portlands, and that 17.3 per cent. of the quantity was rejected for various reasons.

LIGHT, HEAT AND POWER.

James K. Lynn of Detroit, president of the Sheboygan Gaslight Company, has purchased of William T. Clausen and John K. Russell of Sheboygan the patent rights on a new gas arc lamp. Mr. Lynn will begin the manufacture of the lamp at Detroit.

The Peninsular Gas Company, Palo Alto, Cal., has been incorporated to manufacture and sell gas, and will build a gas plant.

The Economical Electric Lamp Company has been incorporated to manufacture incandescent lamps, with principal offices at 25 Grant-st., Newark, N. J. John McCullough, Nicholas Schroder, Thomas E. McIver and Levi Lobenthal are the stockholders.

The Protective Electric Meter Company, Sioux City, Ia., has been incorporated to manufacture and put on the market the new electric meter invented by Charles T. Claypoole. The officers of the company are: President, John A. Magoun, jr.; vice-president, C. W. Taylor; secretary and treasurer, Charles T. Claypoole.

A gasoline lighting plant has been devised by F. W. Priestly of Webster City, Ia., who has applied for a patent.

The Penn Argyl Gas Company, Penn Argyl, Pa., has been incorporated.

Newly incorporated electric light companies: Atlanta Electric Light and Power Company, Atlanta, Ill.; Mineola Light and Power Company, Mineola, Tex.; Union Water, Light and Power Company, Chicago, Ill.; Brilliant Electric Company, Cleveland, O.; Hartel Light Company, Wilmington, Del.; Tucson Gas Electric Light and Power Company, Denver, Col.; National Electric Light, Heat and Power Company, Huron, S. D.; Cape May Illuminating Company, Camden, N. J.; North Hempstead Light and Power Company, Port Washington, N. Y.; Summitville Electric Light and Power Company, Summitville, Ind.; Halcyon Electric Light and Power Company, South Bethlehem, Pa.; Brilliant Electric Company, Cleveland, O.; National Electric Light, Heat and Power Company, Huron, S. D.; Haileyville Electric Light and Ice Company, Haileyville, Ind. T.; Citizens' Mutual Light and Power Company, Staunton, Va.; Keota Lighting Company, Keota, Ia.; Wisconsin Heat, Power and Light Company, Racine, Wis.

MISCELLANEOUS.

The establishment of a plant on Puget sound for the manufacture of wooden water pipe is contemplated by W. E. Hampton and W. J. Woodward, two California manufacturers.

The Brown Construction Company, East St. Louis, Ill., has been incorporated by Walter W. Brown, A. E. Meints and C. W. Dobbins to construct roads, railroads, streets, levees and bridges.

The H. M. Dalton Stone Company of Warrick county, Indiana, has been incorporated to operate in Christian county, Kentucky. J. P. Weyerbacher of Boonville, Ind.; C. P. White and H. M. Dalton are the incorporators.

The Vigo Bridge and Supply Company, Terre Haute, Ind., has incorporated to manufacture bridges, road machinery and school supplies. The directors are Gus A. Conzman, John L. Walsh, William C. Darsey, Fred C. Meredith and Thomas W. Harper.

The Canadian, Eufaula and Gaines Bridge Company, Canadian, I. T., has been incorporated to build toll bridges over the Canadian and Gaines rivers. The directors are John Findlay, Phil Brown, Lee L. Mettinger, G. M. Porter, J. P. Connors, J. F. Mitchell and F. Y. Goldsborough.

G. R. Lynch, Hugh Partridge and Isaac L. Harris, Chattanooga, Tenn., have organized a company to manufacture a patent acetylene gas generator.

The Doylestown Sewerage Company, Doylestown, Pa., has been incorporated to build sewers, intercepting sewers, drain trunks and pipe lines.

The Miami Stone and Concrete Company, Toledo, O., has been incorporated.

The Medina Quarry Company, Albion, N. Y., was incorporated Feb. 15 to conduct a stone quarry, to maintain railroad, water and other transporataion lines, and to erect and operate mills and factories. The directors are Elverton R. Chapman, W. E. Scarritt, Edmund Seymour, L. H. Hole, L. D. Baldwin, Bird S. Coler of New York City, H. S. Le Roy Randall of New Milford, Conn., W. S. Harvey of Philadelphia, Joseph A. Roberts of Buffalo, Gilbert Brady and A. R. Squires of

Rochester. William O'Brien of Holley, Michael Slack of Medina, E. F. Fancher of Albion and M. H. Phillips of Murray.

A patent has been granted Conrad Budke, jr., a student in the Manual Training School Department of Washington University, St. Louis, Mo., for an electric signal which is designated for use in railroads and street railways.

The Fitzgerald Artificial Stone Company will establish an artificial stone plant at Fitzgerald, Ga.

The Blair Bridge and Culvert Company, Indianapolis, Ind., has been incorporated to construct bridges, culvert, viaducts, etc., by N. W. Baker, W. B. Blair, Everett Wagner, B. L. Blair and H. F. Hackedorn.

The Classen Company, Okalahoma, Ok. T., has been incorporated by Anton Classen, George T. Gardner, E. W. Johnston and George H. Blair. The company will contract for municipal improvements.

The Rochester Bridge and Construction Company has purchased the entire plant of the Havana Bridge Company of Montour Falls, N. Y.

The National Bridge Company, Groton, N. Y., contemplates the establishment of a plant at Owosso, Mich.

The Lasador Gas Mining Company has been incorporated in New York City to operate mines in Mexico. The incorporators are J. B. Riley and Y. C. Crawford of New York, W. H. Leaman, El Paso, Tex.

The Scandinavian Gas and Oil Company is being formed at Marinette, Wis., to explore for gas in the premises of Andrew Gustafge & Son.

The Equitable Natural Gas Company, Buffalo, N. Y., has been incorporated by Wm. H. Zaniser of Parkersburg, W. Va.; Jas. Grey, Patrick F. Ryan, Lowis and John N. Conshafter of Buffalo.

The California Stone and Gravel Company, Redlands, Cal., which was incorporated a few weeks ago, has purchased several large additional tracts of land valuable in gravel and stone deposits.

According to press reports of Feb. 8 from Springfield, O., the road roller manufacturers of Springfield, O.; Massillon, O.; Buffalo, N. Y.; Harrisburg, Pa., and Patterson, N. J., have formed a combination.

SEWER PIPE.

The plant of the Red Wing Sewer Pipe Company, Red Wing, Minn., was destroyed by fire Feb. 7, entailing a loss of from $75,000 to $100,000. Valuable machinery, patterns and dies are included in the loss.

The Ogden Sewer Pipe and Clay Company, Ogden, Utah, desires catalogues on brick and sewer pipe mcahinery and supplies.

The Empire Sewer Pipe Works, Empire O., was compelled to shut down Jan. 1 owing to scarcity of cars.

The Big Hill Brick and Tile Company has been incorporated to operate a plant at Tile Works, Ia., a small station on the Davenport, Rock Island & Northwestern railway. The company may acquire the business of Hearlin & Martin. William E. Martin is a director.

The American Brick and Tile Works, Oklahoma City, Ok. T., has been incorporated by I. N. Phillips, C. A. Compton and W. I. Young.

The Standard Brick and Tile Company has been incorporated to build a plant in Richmond, S. I., N. Y. The directors are Frederick, George and C. A. Jones of New York City, and H. J. Gallagher of Brooklyn.

The Renton Clay Works Company, Renton, Wash., will begin the manufacture of vitrified brick, terra cotta, drain tile and sewer pipe, March 1.

The McGowan Conduit and Tile Company, Camden, N. J., has been incorporated.

The Ashton Firebrick and Tile Company, Salt Lake City, Utah, has been incorporated to manufacture firebrick, tile, sewer pipe, crucibles, etc. The officers are: President, Edward T. Ashton; vice-president, George M. Cannon; secretary and treasurer, N. L. Norris.

The Abilene Brick Company, Abilene, Tex., recently organized, is preparing to erect a plant for the manufacture of brick, sewer pipe and other clay products. G. L. Stephenson is interested.

H. A. Mayo of Walhalla, N. D., is reported as having interested Minneapolis and eastern capitalists in his brick and tile industry and a large plant will soon be established.

Capitalists of Cleveland and Warren, O., have formed a company to be known as the Blackburn Brick and Tile company and contemplate the erection of a brick and tile manufacturing plant near Warren.

The Riverside Brick and Tile plant, Riverside, Ia., will be enlarged. H. L. Swift, proprietor.

Recent Inventions.

689,856. Dec. 31, 1901. Lift Bridge. Elmore D. Cummings, St. Paul, Minn. A vertically rotable bridge span of one or more curved members secured to said span near its axis of rotation, a counter weight rotably mounted adjacent to the bridge span upon a support independent thereof and a cable connecting the counter weight with the farther end of the curved members.

689,936. Dec. 31, 1901. Street Sweeper. Alfred Wender, St. Louis, Mo, assignor of one-third to Albert Henry, St. Louis, Mo. An arrangement of switches upon bars attached tangentially upon disks keyed upon a main shaft.

689,944. Dec. 31, 1901. Sprinkler Head. Charles Andrews, South Bend, assignor to the Studebaker Brothers Manufacturing Company. A cylinder having an outer end wall and having spray outlets and flushing outlet in the side of the cylinder controlled by a reciprocating piston.

690,137. Dec. 31, 1901. Tunneling Machine. John E. Ennis, Chicago, Ill. A machine having a digger mechanism, including a rotable plow, means carried on the machine for imparting the sweep movement to the plow and forcing it forward in a spiral direction and moving it from side to side.

690,451. Jan. 7, 1902. Grading and Ditching Machine. Wm. H. Morenus, Lakeview, Ia., assignor to Frederick C. Austin, Chicago, Ill. A new draft arrangement for shifting the draft from the tongue or pole of the plow to the forward bolster of the wheel-supported body frame.

690,727. Jan. 7, 1902. Street Sweeper. David D. Hitchings, Norfolk, Va. A wheeled cart with arms carrying rollers and an endless carrier moving over the rollers operated by gearing between the wheels of the cart and the endless carrier, a rotary brush carried by the arms and operated by a chain connected with the wheels of the cart.

690,960. Jan. 14, 1902. Tunnel. Charles M. Jacobs, New York, N. Y. A tunnel for projecting a passage-way through unstable earthy material, comprising a shell for projecting a passage-way therethrough, a bridge span within said shell and a roadway carried by the bridge span and piers underneath, and supporting the bridge and roadway, the piers extending downwardly through the unstable earthy material to solid foundation.

690,987. Jan. 14, 1902. Mold for Paving Bricks. Wm. H. Nelson, Washington, D. C., assignor of two-thirds to Cuthbert W. Ridley and Frederick Mertens, Washington, D. C. A mold-box having at one side a core-block, and a detachable false shaping bottom provided at one side with a forming boss.

690,988. Jan. 14, 1902. Paving Brick for Track Paving and Fastening Purposes. Wm. H. Nelson, assignor of two-thirds to Cuthbert W. Ridley and Fred Mertens. A brick comprising a body provided in the inner side thereof with a re-entrant holding pockets for the reception of a body of cement and also in its base with a separate re-entrant pocket for the reception of a body of cement and the heads of the track fastening bolts.

691,069. Jan. 14, 1902. Air Lock for Caissons. John F. O'Rourke, New York. An air lock for cassions comprising a shell convex at top and bottom and provided with end openings, a single gate for closing the bottom opening, the gate corresponding in shape to the shape of the shell, a pair of oppositely arranged swinging gates to close the top opening, said gates being geared together so as to move in unison, counter balance for the upper and lower gates, mechanism for working the gates and means for admitting air to and exhausting it from the shell.

691,708. Jan. 21, 1902. Roadway. Frederick A. Marlette, Geneva, N. Y., assignor of one-half to Edward Seyboldt, Geneva, N. Y. A roadway comprising a foundation, a layer of broken stone of varying sizes thereon, the fragments of stone being individually coated with bituminous mineral which forms a bond between the fragments when the latter are submitted to pressure. A filler of stone-dust, stone screenings or the like partially filling the voids between the fragments and acting as a chock to prevent the turning or rolling of the fragments under pressure, and a surface coat or top dressing of tarred screenings or sand, covering the protruding tops of the fragments and filling the spaces between such tops.

692,007. Jan. 28, 1902. Gas Detector. Oscar Freymann and Charles Tolman, Brooklyn, N. Y., assignors to American Equipment Company, New York, N. Y. A combined smoke and gas detecting device comprising an electric belting and signaling device mounted in a frame, a stationary and a movable contact piece, mechanism acting upon the movable contact piece and forcing it in contact with the stationary contact piece; a combustible connecting device connected to the movable contact piece and holding it away from the stationary contact piece. The connecting device is chemically treated and rendered sensitive to the action of smoke, the smoke causing it to elongate and a piece or pieces of porous substance is affixed in proximity to the connecting device; said porous substance being treated with chemical composition and rendered productive of heat when exposed to the action of gas.

692,030. Jan. 28, 1902. Excavating Mechanism for Dredgers. Robert H. Postlethwaite, San Francisco, assignor to Risdon Iron and Locomotive Works, San Francisco. A combination of a support, a ladder, a drum at the other end of the ladder, a tumbler on the support, a carrier working over said drum and tumbler, a connection between the carrier and support located at a point away from the tumbler intermediate of the same and the drum and a means for longitudinally adjusting said ladder.

691,397. Jan. 21, 1902. James D. MacDonell, Little River, Fla. A composition for the manufacture of cement, consisting of three barrels of crushed calcareous rock, one barrel of sulphate of calcium, one barrel cement (any manufacture), four ounces of nitric acid, four ounces of nitro-muriatic acid, one quart of crude carbolic acid and ten gallons of water.

692,231. Feb. 4, 1902. Manhole Casing. Charles F. Bingham, Buffalo, N. Y. An improved manhole device, comprising a casing having a shoulder provided with a groove, a cover adapted to seat on said shoulder, and a packing of soft metal cast in said groove, the device being provided with holes through which the soft metal is run when the cover is in place.

692,386. Feb. 4, 1902. Guard. Herman Ten Broeke, Milwaukee, Wis. The combination with a bridge and one of its abutments of a gate arranged transversely of the approach of the bridge and operated automatically with the moving of the bridge.

692,418. Feb. 14.—Sewer Trap. Herman L. Behrens. A trap comprising a sewer of assembled conical tubular sections, a coupling ring, with a flange to which the upper section is secured, a waste-pipe having a flange located below the flange of the ring and secured to the opposite faces of the sink bottom, a cup depended by straps from the discharge end of the lower section of the trap, the upper edge of the cup being located in a plane above the end of the lower trap section.

692,644, Feb. 4, 1902. Artificial stone and process of manufacturing same. Frederick M. Emerson, Brookline, Mass., assignor

to Murdock Parlor Grate Company, Boston, Mass. An artificial stone, consisting of a concrete of angular (fractured) stone, sharp sand and Portland cement, and an exterior facing or veneer formed of a concrete of small, irregular fragments of marble and Portland Cement, the concrete of the exterior facing and that of the core being intimately united by compression.

693,192. Feb. 11, 1902. Pavement. Henry G. Volkmar, New York, N. Y. An asphalt pavement consisting of an asphalt body, complete self-contained stiffening frames imbedded therin below the surface thereof and breaking joints with each other and an anchor attached to each of three frames at their meeting point.

693,235. Feb. 11, 1902. Asa B. Clark, New York, N. Y. A hollow pile characterized by the following elements, walls braced within, a cap on the upper end of said walls, a shoe on the lower end of said walls beveled toward one edge so as to force the pile against its adjacent pile when driven, and devices on the vertical edges of the pile adjusted to interlock with the vertical edges of the adjacent piles.

693,316. Feb. 11, 1902. Process of Purifying Sewage. Leberecht Trails, Charlottenburg, Germany, assignor to Edward Burmeister, Hamburg, Germany. A process of purifying sewage which consists in adding to the same a mixture containing calcium carbonate and calcium hydrate in approximately equal proportions, in sufficient quantity, according to the pollution of the liquid, to produce in the same a heavy precipitate of large flakes leaving the supernatant liquid clear.

693,475. Feb. 18, 1902. Street sweeper. Zenas Whitemore, Morton, Pa. A sweeper comprising the combination of a vehicle provided with a receptacle for sweeping, a rotary brush, a pan arranged close to and extending under said brush, and means to move said pan backward away from said brush and then upward to discharge its contents into the receptacle.

693,511. Feb. 18, 1902. Sewer Inlet. William H. Garrett and Henry C. Pauly, Springfield, O., assignors to the Hennessy Foundry Company, Springfield, O. A sewer inlet consisting of three members, a rectangular body flush with the street pavement, having vertical sides and enclosing a bowl provided with a circular outlet; a box-like upper portion resting in the rabbeted seat of the body, open at the front and bottom and flush with the curb; having the edge of its front opening provided with an outwardly contracting seat, and an integral grate.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

San Bernardino, Cal.—An ordinance was passed to its second reading Feb. 10 which compels oil wagons to be furnished with a drip pan.

Trenton, N. J.—A bill has been introduced to authorize cities of the second-class to issue bonds to the amount of $150,000 for building sidewalks. The city will do the work under the bill and assess the benefits to the property-owners.

Delphi, Ind.—(Special.)—Judge Vinton has taken the gravel road election case under advisement until the March term of court. The case involves the construction of 32 mls. of roads in Burlington and Democrat townships, and has developed much bitter feeling among the residents of the townships who would be affected by the building of the road.

Aurora, Ill.—Judge Southworth handed down a decision recently refusing to confirm the ordinance for paving W Park-ave. The decision is based on three reasons, the most important of which is that "although the ordinance in several places refers to plats and profiles in the office of the city clerk, the documents mentioned were never filed in that office, but remained with the public engineer."

CONTEMPLATED WORK.

Hancock, Mich.—Bids for paving Quincy-st. will be voted.

Red Jacket, Mich.—The issue of bonds for paving is proposed.

Fowler, Ind.—Fifth-st., from Van Buren to Park-ave., will be paved.

Alliance, O.—Ordinances have been passed for repaving certain streets.

Liberty, N. Y.—The estimated cost of paving Main-st. with brick is $17,800.

Rockford, Ill.—Ordinances are pending for macadamizing Guard and Kent-sts.

Jackson, Miss.—Vitrified brick paving is contemplated for State and Capitol-sts.

Geneva, O.—The establishment and construction of a county road is petitioned for.

Branford, Conn.—Bids will be asked soon for building a section of state highway.

Vancouver, B. C.—The question of better sidewalks is being urged by the local press.

Evansville, Ind.—Artificial stone sidewalks have been authorized in a number of streets.

Indianapolis, Ind.—The question of constructing the Fall creek boulevard is being considered.

Tullahoma, Tenn.—The business men and farmers are agitating the question of good roads.

Oberlin, O.—The question of brick and asphalt paving is being considered by the board of commerce.

Washington, D. C.—A bill has been introduced appropriating $8,500 for grading, macadamizing and regulating Fort-st., between Twelfth and Fourteenth, N. E., Brookland.

Little Falls, N. Y.—Main-st., from Third to William, will be paved with brick. Mayor Kingsbury.

Brooklyn, N. Y.—The improvement of b. Third-st., Harrison-ave. and Rush-st. is contemplated.

Utica, N. Y.—An ordinance has been adopted to let all paving contracts by May 2. Mayor Falcott.

Omaha, Neb.—An ordinance was passed Feb. 18 to pave Cass-st., from Sixteenth to Twenty-second.

Aurora, Ill.—Ordinances were passed Feb. 17 providing for five miles of asphalt paving. Cy. Engr. Pfrangle.

Madison, Wis.—The common council has decided to lay asphalt on the four streets of Capitol-square.

Chicago, Ill.—The board of local improvements ordered, Feb. 18, asphalt paving in a number of streets.

Superior, Minn.—Mayor Parker has signed the resolution for repairing Tower-ave. with cedar blocks.

El Paso, Ill.—Vitrified brick sidewalks are proposed for certain streets. Fred Smith, cy. engr.

Reading, Pa.—The construction of a boulevard along the river is contemplated, according to press reports.

Appling, Ga.—The county contemplates the purchase of a new steam road roller. Geo. W. Gray, ordinary.

Dover, N. H.—The council has appropriated $26,102 for highways and the purchase of a new steam road roller.

Houston, Tex.—The residents have petition for the paving of Hardy-st., from Liberty-ave. to Conti-st.

Ft. Scott, Kas.—The estimated cost of paving Main-st. with vitrified brick is $5,080. St. Comr. Stoner.

Jacksonville, Fla.—Bids will be asked for about May 1 for brick paving. Philip Prioleau, cy. engr.

Belvidere, Ill.—Ordinances have been passed for paving Hurlburt-ave. and N. State-st. Cy. Engr. Marean.

Chicago, Ill.—The improvement of a system of improved streets in the Thirtieth ward is contemplated.

Rockaway Beach, L. I., N. Y.—A boulevard along the bay, between Rockaway Park and Far Rockaway, is contemplated.

Clinton, Tenn.—The question of issuing $100,000 bonds for improving the county roads will be voted on in March.

East St. Louis, Ill.—Bids will be asked soon for 25,000 sq. yds. of brick paving. L. L. Harper, cy. engr.

Redlands, Cal.—The city trustees contemplate taking up the present brick paving and substituting asphalt.

Los Angeles, Cal.—The question of building a boulevard between this city and Pasadena is again being agitated.

Erie, Pa.—Ordinances were finally passed Feb. 10 for repaving portions of Tenth, Ninth, Twelfth, French and Sixth-sts.

San Antonio, Tex.—An ordinance has been introduced appropriating $780 for macadamizing Carneago and Barrera-sts.

Wellsville, O.—A resolution was passed Feb. 4 declaring it necessary to pave Front and Water-sts. with asphalt blocks.

Auburn, N. Y.—Bills were passed in the common council Feb. 17 authorizing the paving of South-st., from Lincoln to Swift.

Lead, S. D.—The city council is investigating the various paving stones and materials preparatory to paving the streets.

Manistee, Mich.—The question of issuing $125,000 bonds for paving certain business streets will be voted on in April.

Duluth, Minn.—The council has ordered Nineteenth-ave., east, paved with tar macadam from Fourth to South-st. City Engr. Patton.

Milwaukee, Wis.—The board of public works has recommended brick and asphalt paving for a large number of streets this year.

Kalamazoo, Mich.—A resolution has been passed for 1,300 lin. ft. of asphalt paving in Academy-st. E. W. Buckley, Cy. Engr.

Mankato, Minn.—The question of paving or macadamizing the streets is being considered. Mayor Peterson. Cy. Engr. Thompson.

Janesville, Wis.—Resolutions have been adopted for macadamizing S. Jackson and N. Franklin-sts. and Milton-ave. Mayor Richardson.

Birmingham, Ala.—An ordinance has been adopted providing for paving the sidewalks in a large number of streets with artificial stone.

Brainerd, Minn.—Estimates of the cost of paving Front, Fourth, Sixth, Eighth and Kindred-sts. will be submitted by the city engineer.

Southington, Conn.—At a meeting of the board of wardens and burgesses, Feb. 11, it was decided to continue the new macadam road to Plantville.

Oshkosh, Wis.—Portions of six streets will be paved. Brick and asphalt is proposed for Algoma and Washington-sts. Geo. Randall, cy. engr.

Ogden City, Utah.—Notice of intention is being published to grade, pave, curb and gutter Washington-ave. W. J. Critchbow, cy. recorder.

Freeport, Ill.—The estimated cost of paving Galena-st. and the intersecting streets north to Stephenson, 20,300 sq. yds. with brick, is $35,581.

Rockford, Ill.—The city engineer has been instructed to secure bids for yellow pine blocks for paving the Girder-st. bridge this summer.

Omaha, Neb.—The citizens of South Omaha will ask the government to macadamize Thirteenth-st., from the southern limits of Omaha to Ft. Crook.

Edwardsville, Ill.—The city engineer has been directed to report an estimate of the cost of paving the streets with vitrified brick.

Baker City, Or.—(Special.)—R. D. Carter, mayor, says that this city will do considerable street paving within the next two or three years.

Washington, D. C.—The district commissioners have ordered new cement sidewalks, curbing, extension of streets, etc., under the assessment plan.

Niles, O.—The residents of N. Main-st., from Church-st. to Park-ave., will circulate a petition for paving that street.

St. Joseph, Mo.—The residents on Ninth-

st., from Frederick to Mitchell-ave., have petitioned for macadam paving. Wm. H. Floyd, Jr., cy. engr.

Bay City, Mich.—The recommendation of the board of public works for one-half mile of asphalt paving on Center-ave. has been adopted. Wm. Cunningham, mayor.

Stroudsburg, Pa.—An ordinance has been passed for paving the sidewalks of Pocono bridge, along Main-st. and Dreker-ave. with flagstone. Mayor Staples.

Dunbar, Pa.—A franchise granted to the Pittsburg, McKeesport & Connellsville Street Railway Company requires it to pave Connellsville-st. its entire length.

Athol, Mass.—Plans for building a road to Gay & Ward's factory have been prepared. The question of constructing it will probably be settled in April.

Topeka, Kas.—James McCabe, Cy. Engr., has received the newly printed paving specifications for 1902, in which some important changes and additions have been made.

Atlantic City, N. J.—Resolutions were introduced at the meeting of the board of freeholders, Feb. 12, providing for the construction of several miles of new county roads.

Syracuse, N. Y.—An ordinance was referred to the highway committee Feb. 10 for paving Oak-st., from James to Green, with asphalt or brick. Frank A. Schnauber, cy. engr.

Little Rock, Ark.—A resolution was adopted Feb. 12 authorizing the board of public affairs to ask for bids for paving 49 blocks of streets with asphalt. Mayor Duley.

Bradford, Pa.—(Special.)—The joint finance committee of councils has provided an appropriation for paving Main and Congress-sts. with vitrified brick. A. F. Bannon, cy. engr.

St. Joseph, Mo.—Brick sidewalks will be constructed on Sixteenth, Lincoln, Twenty-sixth, Messamie, Twenty-fourth, Twenty-ninth and Twenty-eighth-sts., and Whitehall-ave.

Riverside, Cal.—Messrs. C. H. Low, George N. Reynolds and other property-owners along Palen-ave. are agitating the question of improving that street from Jurupa to Magnolia-ave.

St. Louis, Mo.—The improvement of Westminster-place, from Spring to Walton-aves., and Washington-ave., from Grand to Saylor-aves., with creosoted wood blocks is contemplated.

Seattle, Wash.—Estimates have been submitted for constructing concrete sidewalks on 12 streets. Plans have also been offered for curbing and parking a number of streets.

Joliet, Ill.—The city council passed ordinances Feb. 10 for paving with asphalt Joliet and Clinton-sts. and Western-ave.

Ft. Madison, Ia.—The Democrat says that the main business portion of the city has about 2 mis. of brick paving, but much more of it should be constructed, and probably will be in the next few years.

Pasadena, Cal.—Resolutions have been approved for paving the walks of Locke, Haven and Arbor-sts. with cement, and graveling, curbing and grading Walnut-st. H. M. Weight, mayor; Heman Dyer, cy. engr.

Riverside, Cal.—Lemon-st., from Fourteenth-st. to Prospect-ave., will be graded and graveled with cement and concrete gutter and the sidewalks graded and graveled. George F. Serger, supt. sts.

St. Louis, Mo.—Plans have been prepared for cutting a strip about 250 ft. wide from Forest Park, between Union boulevard and Skinker-road, and constructing a boulevard as a prolongation of Lindell boulevard.

Saginaw, Mich.—The estimated cost of paving and repairing Genesee-ave., from Hoyt-ave. to Hartstuff-st., is $9,457. A resolution has been adopted for macadamizing Tuscola-st., from Warren-ave. to Park-st. H. E. Terry, cy. engr.

Ft. Worth, Tex.—The contractors who are constructing the brick paving on Main-st. have submitted a proposition offering to pave the public square in brick on concrete, or using the present gravel pavement for a foundation in lieu of concrete.

Ventura, Cal.—Messrs. George Power, John Hammas, John Lagomarsino and James Blackstock, a committee from the board of trade, called on the board of supervisors Feb. 7 to enlist county aid in building the proposed Thompson boulevard.

Ft. Wayne, Ind.—(Special.)—A. M. Schmidt, clk. B. P. W., says that owing to the scarcity of oak lumber this city will have to abandon that material for street and alley crossing purposes, and will substitute stone and brick crossings.

Columbus, O.—Bids for improvements have been authorized as follows: From Buttles-ave. to Poplar-st., curb and gutter; Sherman-ave., from Oak-st. to Fair-ave., brick or other paving; Thurman-st., from Blackberry-alley to Persons-ave., curb and gutters.

Great Falls, Mont.—(Special)—C. W. Swearingen, Cy. Engr., says that improvements are contemplated during 1902 as follows: Grading and boulevarding 3½ mis. of avenues; grading and boulevarding one mile of avenue; grading and macadamizing a street and constructing subway under railway tracks.

La Crosse, Wis.—(Special)—Frank Powell, Cy. Engr., says that paving is contemplated as follows: 6,700 sq. yds. of brick paving at cost of $14,000, 66,000 sq. yds. of granite top macadam with 30,000 lin. ft. of concrete curb and gutter at cost of $65,000. Bids will be received about April 1.

Grand Rapids, Mich.—City Engr. Anderson is holding up street improvement work according to local press reports, in order to give the city the benefit of greater competition. The proposed work involves the following: Paving Cherry-st. with asphalt, Wealthy-ave. with asphalt, brick or asphalt blocks.

Paris, Ill.—The proposed paving of Main-st. will come up for approval, March 3, and it is hoped that the contract will be let by April 1. The paving will be of brick with stone curb from Wood-st. to

the railroad, and with combined cement curb and gutter from Edgar-st. to Blackburn. W. C. Lemon, cy. engr.

Baltimore, Md.—Specifications for paving during 1902 have been approved at follows. Trap rock asphalt block—Fulton, North, Warren and Ashland-aves. and McCulloh-st.; asphalt—St. Paul-st., from North-ave. to Twenty-fifth-st.; Belgian blocks—Hanover-st., from Fort-ave. to Winder-st. Cobblestone paving is proposed for Brunt-st.

Peoria, Ill.—Ordinances are pending for paving with brick Glen Oak-ave., from Jackson-st. to Wisconsin-ave.; Warren-ave., from Prairie-st. to Lincoln-ave.; the alley in block 41 in Monson & Sanford's addition; improving St. James-st., from Elizabeth to University; Glen Oak-ave., from Knoxville to Jackson-st.; Randolph-ave., from North to Chambers-ave. Mayor Bryan.

Brooklyn, N. Y.—Wm. C. Redfield, Com. Pub. Wks., announced, Feb. 17, that such funds as are allotted for repaving in this city this year will be expended on streets in front of hospitals and schools; blocks where property owners contribute half the cost of repaving and gaps between smooth pavements. New thoroughfares will not be considered until the above are accomplished.

New York City.—The plans for the Grand Concourse and boulevard provide for a central driveway 56 feet wide, specially surfaced for fast driving. On either side will be bicycle paths and macadam roadings for general use. The side walks will be 24 feet wide with 8 feet of flagging in the center. Trees will be planted along the curb line. A contract will be awarded for as much of the work as can be completed in one year.

CONTRACTS TO BE LET.

Salem, O.—Sealed bids are asked until March 3 for paving sundry streets with brick. Geo. Holmes, cy. clk.

Cleveland, O.—Sealed bids are asked until March 12 for paving certain streets with asphalt. Chas. P. Salen, dir. pub. wks.

Laporte, Ind.—Sealed bids are asked until 6 p. m. March 3 for paving a number of streets with macadam. W. H. Hans, cy. clk.

Cincinnati, O.—Sealed bids are asked until 12 m. March 8 for improving Columbia road, in Sycamore twp. E. L. Lewis, co. audt.

Marion, O.—Sealed bids are asked until March 15 for 6,700 sq. yds. of vitrified brick or block paving. E. S. Ault, cy. engr.

Connersville, Ind.—Sealed bids are asked until April 17 for constructing 400,000 sq. ft. of cement walks. Karl L. Hanson, cy. engr.

Erie, Pa.—Bids will be received until 7:30 p. m. March 10 for paving Twenty-first-st., from Peach to Sassafras, according to press reports.

Glens Falls, N. Y.—Sealed bids are asked until March 10 for 12,000 sq. yds. of vitrified block paving. T. J. Dillon, clk.; Geo. P. Slade, cy. engr.

Madison, Ind.—Sealed bids are asked until 10 a. m. March 5 for building 26.25 miles of gravel road in Graham tp. Jas. W. Reed, chmn. co. comrs.

Indianapolis, Ind.—Sealed bids are asked until 10 a. m. March 14 for constructing one-half mile of gravel roadway in Brookside park. Chas. E. Coffin, chmn. bd. park comrs.

Duquesne, Pa.—Sealed bids are asked until March 3 for 25,000 cu. yds. of embankment, 3,870 sq. yds. brick paving, 2,100 ft. curbing. S. A. Taylor, boro engr., 339 Fifth-ave., Pittsburg.

St. Paul, Minn.—Bids will be received until 2 p. m. March 3 for improving a large number of streets and for paving eight streets with asphalt and certain streets with brick and sandstone. B. P. W.

Silver City, Idaho.—Sealed bids are asked until 2 p. m. April 14 for improving and keeping in repair the public roads and highways in road dist. No. 2. Chas. Forney, chmn. co. comrs.; E. L. Ballard, clk.

Atlanta, Ga.—Sealed bids are asked until 3 p. m. March 3 for asphalt paving as follows: Pryor and Hunter-sts., 5,400 sq. yds.; Whitehall-st., 6,100 sq. yds.; Peachtree-st., 9,400 sq. yds. R. M. Clayton, cy. engr.

Crawfordsville, Ind.—Sealed bids are asked until 4 p. m. March 10 for paving Washington-st., from Chestnut-st. to Wabash-ave., and from Chestnut to Spring-st., with asphalt, bituminous macadam and brick. Jas. A. McClure, cy. clk.

Cincinnati, O.—Sealed bids are asked until 12 m. March 10 for paving Piedmont-ave., from Burnet to Eden-ave., with brick and until 12 m. March 12 for macadamizing Wold-ave., from Fairfax to Hewitt-ave. Robt. Allison, prest. B. P. S.

Toledo, O.—Sealed bids are asked until 12 m. March 3, for paving Greenwood-ave., with vitrified block. Kreodone creosoted wood blocks, asphalt blocks or asphalt, and Bancroft-st., from Ashland to Lawrence-ave., with asphalt blocks. John E. Connell, cy. clk.

Wellsville, O.—Sealed bids are asked until 12 m, March 17, for paving Kelley-ave., as follows: Excavation without classification, 700 cu. yds.; vitrified brick paving, 4,584 sq. yds.; dressed curbing, 2,560 lin. ft.; circular curbing, 180 lin. ft.; crossing stone, 371 lin. ft. J. W. McQueen, cy. clk.

Auburn, Ind.—Sealed bids are asked until 8 p. m., March 12 for paving with brick, asphalt, creosoted block or any other paving material adopted by the council, as follows: Excavation, 15,000 cu. yds.; paving, 37,000 sq. yds.; straight curb, 16,000 lin. ft.; marginal curb, 2,000 lin. ft.; radial curb, 1,500 lin. ft.; new street inlets, 72; new manholes, 3; old manhole tops to be adjusted, 20; new cement walk, 10,500 sq. ft. C. D. Weaver, cy. clk.; D. A. Garwood, mayor.

CONTRACTS AWARDED.

Newark, N. Y.—Contracts were awarded Feb. 10 for grading and paving as follows: Ridge road, 2 mis. in Verona, T. J. Marley, $11,208; W. Passaic-ave., 1 mi. in Bloomfield, Osborne & Marcellus, $8,233.15;

Sandford-st., 1 mi. in Vailsburg, $13,602; Mountain road, 3 mis. in Caldwell, R. C. McMann, $28,740.

Steubenville, O.—The contract for paving South-st. with block was awarded to Harry Bates.

York, Pa.—E. Neuberger was awarded the contract Feb. 12 for grading Branberry-st. at 30 cents a cu. yd.

St. Paul, Minn.—Fielding & Shepley secured the contract Feb. 18 for repairing Selby-ave. for $7,022.75.

Hartford, Conn.—The contract for macadamizing the roads has been awarded to A. C. Sternberg of West Hartford.

Eatonton, Ga.—The contract for paving the sidewalks with brick in the business nart of town was awarded to Hearn & Greene.

Columbus, O.—The Barber Asphalt Paving Company was awarded the contract for paving Buckingham-st. with brick for $13,874.

Denver, Col.—The contract for constructing sidewalks in district No. 5 was awarded Feb. 6 to Sites & Buell at 72 cts. a running ft.

South Bend, Ind.—C. H. Defrees was awarded the contract for paving Eddy-st., and James Nelson for paving Laurel-st. with brick, Feb. 10.

National Military Home, O.—The contract for constructing 2,542 sq. ft. of cement roadway and crossings at the Home was awarded to Ellsworth Brentlinger of Dayton.

Seattle, Wash.—The contract for improving Twentieth-ave. was awarded to Hans Peterson for $5,673. The contract for grading Melrose-ave. was awarded to George Cessna for $5,631.

Sheffield, Ala.—The contract for constructing concrete walks on Montgomery-ave. was awarded to B. Niehaus & Co. of Cincinnati, O., at $1.06 a sq. yd. and 50 cts. a lin. ft. for curbing.

Joliet, Ill.—Curbing contracts were awarded Feb. 17, as follows: Fifth-ave., Frank Murphy, $1,105.96; Akin-ave., C. A. Carlson, $844; C. J. Smith was awarded the contract for paving the alley in the rear of the theater building with brick for $868.60.

Baton Rouge, La.—The Louisiana Improvement Company was awarded contracts Feb. 6 for asphalt paving as follows: Main-st., 8,650 sq. yds.; North Boulevard, 9,031 sq. yds. The contract price was $2.50 a sq. yd., 10 years' maintenance. The company sub-let the contract for 6,600 lin. ft. of curb to D. C. Buntin of Indianapolis. The Barber Asphalt Paving Company bid $2.22 with 5 years and $2.47 with 10 years' maintenance.

Nashville, Tenn.—Contracts for maintaining the recently purchased roads were awarded Feb. 15 as follows: Chicken pike, Jake Young, 3 cts. a bushel for furnishing rock macadam and 37½ cts. a cu. yd. for gravel; Franklin College road, first section, Robert Campbell, 3 cts. for stone and 60 cts. for gravel; second section, C. L. Jenkins, 3 cts. for stone and 75 cts. for gravel.

SEWERS.

Kansas City, Mo.—Henry Long was awarded $2,000 Feb. 6 by a jury, for damage to his property by the close proximity of the Turkey creek sewer and its tributaries.

Altoona, Pa.—Special—Harvey Linton, Cy. Engr., says that William H. Herr of this city has been awarded the contract for constructing a retaining wall 285 feet long and from 10 to 18 feet in hight, on the northwest side of Thirteenth-ave., between Fifteenth and Sixteenth-sts., with steps. The prices are as follows: Square broken range work masonry in American Portland cement mortar, $6 per cu. yd. Cut stone coping, $2 per lin. ft.; cut stone steps (7x13), $1.20 per lin. ft. Shale excavations, $1.30 per cu. yd. For removing houses Nos 1316, 1318, 1320 and 1324, 10 to 16 ft. northwestward, $150 each. New cellar walls under these houses, $4.50 per cu. yd. (excavation, $1.30 per c. y.).

A sewer will be constructed back of the wall for the use of the properties 1330 to 1318, $.80 per lin. ft. The material back of the wall is shale. This shale-rock dips about 45 degrees northwestward.

Concrete was intended to be used for this wall, but there was great opposition to it, and stone masonry was substituted for concrete.

CONTEMPLATED WORK.

Tucson, Ariz.—The city will extend its sewers.

Douglas, Wyo.—Bonds for building sewers will be issued.

Jenning, Ia.—Plans for a sewerage system have been adopted.

Hazleton, Pa.—A sewerage system is proposed for West Hazleton.

Akron, O.—Sewers are proposed for Edgewood-ave. and State-st.

West Homestead, Pa.—Bids will be asked at once for building sewers.

Selma, Cal.—Estimates for a sewerage system have been prepared.

Somers' Point, N. J.—A sewerage system is contemplated. E. A. Higbee, mayor.

Lockhart, Tex.—Preliminary surveys for a sewerage system are being made.

Syracuse, N. Y.—The proposed Butternut-st. trunk sewer will be built this spring.

Warsaw, N. Y.—Plans for a sewerage system have been prepared by Knight & Hopkins.

Edwardsville, Ill.—A sewerage system is contemplated. N. E. Bosen, mayor.

Redding, Cal.—The question of issuing bonds for building sewers will be voted on.

Pittsfield, Mass.—About $50,000 will be expended this year on finishing the sewage disposal plant.

Taylor, Tex.—The question of building a sewerage system will probably be voted on in April.

Orangeburg, S. C.—A sewerage system will probably be built within the next year. J. C. Doyle, mayor.

Lawrence, Kas.—The estimated cost of completing the Shanty Pond sewer is $50,600. City Clerk Marble.

Moorestown, N. J.—This city contem-

plates issuing $25,000 bonds for completing the sewerage system.

Hutchinson, Kas.—The plans for the proposed sewerage system will probably be ready to bid on in March.

Pekin, Ill.—The construction of sewers on the South Side is contemplated, at a cost of $45,000.

Rockaway Beach, L. I., N. Y.—Specifications are being made for a trunk sewer. The estimated cost is $450,000.

Findlay, O.—Plans for sewers in W. Crawford-st. and Briggs-ave., are being prepared. John W. S. Riegler, cy. engr.

North Plainfield, N. J.—Mayor Smalley has appointed a committee to consider the feasibility of sewage disposal.

Sheboygan, Wis.—Plans and specifications for about 41,000 ft. of sewer have been prepared. C. W. Boley, cy. engr.

Kansas City, Kas.—A resolution has been passed providing for the construction of a sewerage system for Armourdale.

Great Falls, Mont.—(Special.)—C. M. Swearingen, cy. engr., says that 2 1-3 mis. of sewers are contemplated during 1902.

Bradford, Pa.—(Special.)—The joint finance committee has provided an appropriation for constructing 1 mi. of sewers.

Denver, Col.—The property-owners in North Denver have petitioned for 11 blocks of sewer in their section of the city.

Columbia, S. C.—Plans for a sewer system have been completed and the contract will be let about March 1. D. B. Miller, cy. clk.

Morristown, N. J.—The aluermen have under consideration a bill providing for an election on the question of a sewerage system.

Louisville, Ky.—Preliminary surveys for a new sewer for the southern part of this city have been made. J. B. T. Breed, cy. engr.

San Diego, Cal.—Bids for reconstructing the outfall sewer and building a pipe sewer on Twenty-eighth-st., will be asked for.

Beaver Dam, Wis.—A resolution has been adopted to construct an 8-in. sewer in High-st., from Second to Center. F. J. Mirlach, cy. clk.

Patchogue, L. I., N. Y.—The question of issuing $10,000 bonds for a sewer on Rider-ave., from Main-st. to the bay, will be voted on March 18.

Nashville, Tenn.—An ordinance has been introduced to appropriate $20,000 for the construction of a trunk sewer in northeast Nashville.

Ilion, N. Y.—The board of sewer commissioners has asked that the question of issuing $84,500 bonds for building new sewers be voted on.

Fresno, Cal.—The city engineer has been directed to make plans and specifications for a sewerage system for the river additions to this city.

Port Huron, Mich.—The construction of a tile sewer in Huron-ave., from River-st. to Black river, has been authorized. W. N. Phelps, cy. clk.

The construction of sewerage systems is contemplating at the following places: Storm Lake, Ia.; Griffin, Ga.; Bessemer, Ala.; Fayetteville, Ark.; Tewksbury, Mass.; Brevard, N. C.

Ottawa, Ill.—Plans for extensive additions to the sewerage system have been completed and the sewers will be built this year. Chas. F. Wilson, cy. engr.

Olean, N. Y.—Mayor Fred L. Downs was granted permission by the state superintendent of public works recently to make a sewer connection with the Erie canal.

The question of issuing bonds for the construction of sewerage systems will be voted on at the following places: Fernandina, Fla., March 17; Moundsville, W. Va.

The question of issuing bonds for the construction of sewerage systems has been favorably voted on at the following places: Anderson, S. C.; Cheyenne, Wyo.

Terre Haute, Ind.—The city engineer has been instructed to prepare estimates for a sewer on Fourteenth and Eighth-sts. and Sixth and Seventeenth-aves.

Cincinnati, O.—Plans and specifications for a sewer in Fairfax-ave. approved. Estimated cost, $5,686. The property-owners have petitioned for a sewer in Beresford-ave.

Des Moines, Ia.—A resolution was adopted Feb. 12 authorizing the construction of an intercepting sewer from Union park to the terminus of the Highland park sewer.

Red Bank, N. J.—The sewage disposal system proposed by Henry Grant of Middleton and Dr. A. G. Brown of this city has been accepted by the sewerage commissioners.

Ft. Edward, N. Y.—Plans have been prepared for the proposed sewerage system. The plans provide for nine miles of sewers at a cost of $55,000; septic tank, $7,400; filter beds, $11,000.

Chicago, Ill.—An ordinance has been introduced in the city council creating a sewerage district between Forty-sixth and Forty-seventh-sts., California and Washtenaw-aves.

Hermosa Beach, Cal.—(Special.)—Plans for sewers and sewage disposal have been prepared by Geo. S. Pierson, M. Am. Soc. C. E. of Kalamazoo, Mich. A sewage pumping station will be required.

Morristown, N. J.—An effort is being made, according to press reports of Feb. 20, to defeat the passage of the bill providing for a sewerage system for this city. The bill provides for the expenditure of $400,000.

Erie, Pa.—The select and common councils will meet in joint session March 3 with the water commissioners, Mill Creek commissioners and members of the board of trade, to discuss the new intercepting sewerage system. Mayor Depinet.

Atlanta, Ga.—Council unanimously adopted, Feb. 17, the favorable report of the finance committee on the resolution providing that $25,000 of the public utility corporations funds be set aside for extending the trunk sewers.

Baker City, Or.—(Special.)—R. D. Carter, mayor, says that the city council has authorized him to secure the services of a competent engineer to make estimates, plans, etc., for a sewerage system and

the best methods for disposing of the sewerage.

Sacramento, Cal.—The plans for the new sewerage system, prepared by Rudolph Hering of New York City, provide for a pumping station near Eighth and T-sts., with an outflow out T-st. west into Sacramento river. All the sewers are to be egg-shaped and of brick. The proposed system covers the entire city.

Taunton, Mass.—(Special.)—The sewer commissioners will, at an early date, ask for an appropriation to carry forward the work upon the sewage disposal system. It is probable that nothing will be done this year toward the construction of the filter bed, which it is proposed to locate in the town of Berkley, south of this city.

Washington, D. C.—The district commissioners have ordered the construction of stoneware sewers in a large number of streets, under the assessment system. The standing committee of the Washington board of trade has appointed several sub-committees, each to have charge of the sewerage system of a particular part of the district.

Philadelphia, Pa.—This year's appropriation for sewers is as follows: Twenty-first-st., $15,000; York-st. extension, $40,000; Pratt-st., $20,000; Gorgas-run extension, $35,000; Thomas-run extension, $15,000; Orthodox-st., $40,000; Anderson-st., $25,000; Lincoln-ave., $10,000. According to estimates made by the survey bureau for this year $3,635,000 is needed for new sewers. This amount would provide for 38 sewers. In the proposed $5,000,000 loan there is an item of $400,000 for new sewers.

CONTRACTS TO BE LET.

Ashland, O.—Sealed bids are asked until Mar. 27 for constructing a sewerage system. S. W. Hull, cy. clk.

Toledo, O.—Sealed bids are asked until 12 m., March 3, for building a cylindrical block sewer and a pipe sewer. John E Connell, cy. clk.

Sioux City, Ia.—Bids are asked until Mar. 22 for completing the construction of the Wodbury-Monona ditch in Woodbury county. N. Jenness, co. audt.

Winchester, Ind.—Sealed bids are asked until March 6 for constructing a lateral sewer 1,600 ft. long, containing one line of 10-in. sewer pipe, and automatic flush tank, manholes and lamp holes. C. C. Yunker, cy. engr.

CONTRACTS AWARDED.

Rochester, N. Y.—F. A. Brotsch was awarded the contract for the Ketcham-st. sewer for $897.

Mayville, N. D.—The contract for a sewerage system was awarded to Jas. Kennedy of Fargo, N. D., for $13,603.

Seattle, Wash.—The contract for building the Thirteenth-ave. sewer system was awarded to F. McLellan & Co. for $26,992.68.

Newark, N. J.—The contract for constructing section one of the trunk sewers was awarded to T. J. Shea of Quincy, Ill., for $126,251.15.

Williamsport, Pa.—(Special)—The contract for constructing Section No. 1 of the Locust-st. stone sewer was awarded to W. W. H. Cookman of Niagara Falls, N. Y., for $45,305.50 on plan "A," which provided for an all-brick section of sewer with concrete foundations where required.

Woodbury, N. J.—B. F. Sweeten & Son of Camden secured the contract for completing the sewerage system in this city for $45,246.14.

New Hartford, N. Y.—The contract for a new sewerage system was awarded Feb. 7 to W. W. Lyster & Co. of Schenectady, N. Y., for $16,914.07.

Fon du Lac, Wis.—The contract for completing the Amory-st.' sewer was awarded to Harding & Nelson of Racine, and for the Cotton-st. sewer to R. J. Bloedel.

Dubuque, Ia.—O. G. Kringle was awarded the contract for a sewer in Thirteenth-st. for $736.40, and Dolen & McDonald for a sewer in Diagonal-st. for $256.

Chicago, Ill.—The contract for 40,000,000 sewer brick was awarded to the Illinois Brick Company at $5.18 per 1,000 f. o. b. cars, or $5.43 per 1,000 at the sewer.

Pittsburg, Pa.—Contracts for small sewers were awarded Feb. 15 as follows: Arlington-ave., Walnut, Summerlea and Downing-sts., W. C. Fishburn; Callowhill, Jumonville and Colwell-sts., Cronin & O'Herron; Commercial-st. and Larimer-ave., Sweeney & George; Forty-fifth, Davidson and Marrow-sts. and Penn and Lincoln-aves., Jas. H. McQuade; Northumberland-st., Wm. Mulanphy; Jane-st. and Wright's-alley, Fred Vogel; Marchand-st., J. B. Sheets & Co

WATER-WORKS.

Tacoma, Wash.—This city has decided to purchase the Philips Water Works plant in South Tacoma at a price of $3,850.

Lewiston, Idaho—The Water Company was defeated in the district court in an attempt to enjoin the sale of municipal water works bonds. The case will be appealed to the supreme court.

Joliet, Ill.—The Illinois supreme court has enjoined this city from issuing water fund certificates to the amount of $240,000 for purposes of enlarging and extending the existing water works system.

Newly incorporated water companies: Richmond Pioneer Water Works Company, Richmond, Utah; Trinity Water Works and Improvement Company, Trinity, Tex.; Collinsville Water Works Company, Edwardsville, Ill.; City Water Company, Irvington, Ind.

Frankfort, Ind.—An official test of the water works was made recently under the direction of Charles C. Brown of Indianapolis, D. W. Meade of Chicago and A. J. Hammond of South Bend. The result of the test was successful and satisfactory.

Cincinnati, O.—The city was awarded $238,712 for damages, Jan. 31, by a jury in a suit against the Lane & Bodley Company of Cincinnati and the American Bonding and Trust Company. The city sued for $302,600, the difference between the Lane & Bodley Company's bid for the pumping engine for the new water works and the amount at which the contract

was subsequently awarded to the Camden Iron Works, the next highest bidder.

Ann Arbor, Mich.—The Ann Arbor Water Company secured an injunction against the city, the mayor and the marshal Jan. 30 restraining them from enforcing the provisions of the recent ordinance cutting the rates down nearly one-half. A bill in chancery has also been filed which seeks to have the ordinance declared null and void on the ground that it impairs the obligations of a contract within the meaning of the constitution of Michigan and the United States and that it fixes unreasonable rates on the company.

CONTEMPLATED WORK.

Salisbury, Me.—Plans for water works are being prepared.

Vernon, Cal.—The extension of the water mains is proposed.

Jeffersonville, N. Y.—Plans for water works are being prepared.

Jennings, La.—Plans for a water works system have been adopted.

Mannington, W. Va.—A reservoir and new water mains are contemplated.

Colorado Springs, Col.—The extension of the water mains is proposed.

Mitchell, S. D.—The question of installing water meters is being considered.

Perth Amboy, N. J.—(Special.)—A new $180,000 reservoir will be constructed.

Milton, Mass.—The legislature will be asked to grant a new water supply.

East Liverpool, O.—Bids will be asked soon for furnishing water pipe for the year.

Green Bay, Wis.—An independent water supply for fire protection is proposed.

Winona, Minn.—Fire protection to the Sugar Loaf district is contemplated.

Mt. Holly, N. J.—A water filtration system is proposed according to press reports.

Jamestown, N. Y.—The question of building a new municipal water plant will be voted on.

Whitehall, Ill.—Plans and specifications for extending the water works have been adopted.

Waupun, Wis.—The purchase of a compressed air lift for the city wells is contemplated.

Plankinton, S. D.—This city is reported as sinking artesian wells for a water supply.

Kalamazoo, Mich.—The construction of additional water mains is contemplated. Mayor Mills.

Seattle, Wash.—The question of extending the water system to Ballard is being considered.

Florence, S. C.—The question of issuing bonds for extending the water mains will be voted on soon.

Nashville, Tenn.—The question of using meters on the sprinkling pipes is being considered.

Anderson, Ind.—The extension of the mains to the southeastern part of the city is contemplated.

Lidgerwood, N. D.—The question of an artesian well for fire protection will be voted on in April.

Ponca City, O. T.—The question of issuing $10,000 bonds for extending the water works system will be voted on.

Meadville, Pa.—A bill is pending in the councils appropriating $20,000 for the purchase of a new water pump.

Nashville, Tenn.—A bill has been introduced to appropriate $1,500 to buy an air compressor for the water works.

Lynn, Mass.—The annual report of the public water board urges the wisdom of increasing the storage capacity.

Kiron, Ia.—An error in the mayor's election notice will require another election on the water works question.

Milwaukee, Wis.—The residents of North Milwaukee are desirous of connecting with the water works system of this city.

Cape May, N. J.—The council is reported as having asked for permission to issue $100,000 bonds for water works and sewers.

Elkton, Ky.—A committee has been appointed to formulate plans and receive bids for water works. C. A. Denny, mayor.

Lewiston, Idaho—(Special)—Ernest McCullough, Cy. Engr., says that the contract for water works will be let about April 1.

Redwood Falls, Minn.—G. L. Parkhill, Supt. W. W., says that a meter system will probably be installed by the middle of the summer.

Kansas City, Mo.—Resolutions have been adopted recommending the construction of 19 water mains in the residence districts.

Marseilles, Ill.—Local capitalists are talking of forming a company and asking for a franchise to construct a system of water works.

Harrisburg, Pa.—The question of issuing $1,090,000 bonds for water filters, sewers, paving, etc., was favorably voted on. V. C. McCormick, mayor.

Mt. Clemens, Mich.—This city contemplates the purchase of a 3,000,000-gal. pumping engine for the water works system. Henry C. Benton, cy. clk.

Pleasant Ridge, O.—This village and Kennedy Heights are endeavoring to secure a water supply from Cincinnati through an extension of the main from Oakley.

Lockport, N. Y.—The water board has recommended that a new location be obtained for the water works, as the present source of supply is contaminated by sewage.

Paulding, O.—Bids are desired for sinking test wells for water works. The contract for the water plant will be let about April 1. W. A. Savage, clk. w. w. trustees.

Los Angeles, Cal.—The new water commission is arranging for construction of a new infiltration gallery at the Buena Vista pump station. The work will begin at once.

Aurora, Ill.—Plans and specifications for a new reservoir to supply this city with pure water will be prepared by H. D. Hollett and bids will be asked as soon as they are completed.

Buffalo, N. Y.—The Depew & Lake Erie company has been incorporated in this

city to furnish water from Lake Erie to towns, villages and people in Erie and Niagara counties.

Lexington, Mo.—The city council has authorized the city register and treasurer to advertise for bids for constructing a water works system under a new franchise. John C. Young, mayor.

Prairie du Chien, Wis.—The committee on water works has been authorized to employ a competent engineer to prepare plans and specifications for a water works system. Mayor Grelle.

Kirkwood, Mo.—The Missouri Water, Light and Traction Company has been granted a permit to lay pipes from the Missouri river west of Creve Coeur lakes through this city and Webster Grove.

Baker City, Or.—(Special.)—R. D. Carter, mayor, says that this city is now offering for sale $45,200 of 5 per cent. 20-yr. bonds for the purpose of extending the present water mains.

Kansas City, Mo.—A joint resolution was adopted Feb. 14 providing that a committee at once set out to locate a site on which to build a pumping station, as recommended by the experts.

Jamestown, N. D.—The city council has decided to sink no more artesian wells, but to investigate the matter of a pumping plant. An engineer will be employed to make estimates for a water works plant.

Woodstock, Ill.—An ordinance has been passed to construct a system of cast iron water mains with fire hydrants and gate valves in Douglas and Calhoun-sts. Geo. W. Lemmers, cy. clk.

Aurora, Ind.—The committee's report favoring municipal ownership of the water works plant is unanimously favored by the citizens, who are also in favor of combining the water works and electric light plants.

The question of issuing water works bonds has been favorably voted on as follows: Cheyenne, Wyo.; Comanche, Tex.; Liberty, Mo.; Dillon, Mont.; Alexandria, S. D.; Brewster, Minn.; Schuylkill Haven, Pa.; Alexandria, S. D.

Great Falls, Mont.—(Special.)—C. W. Swearingon, Cy. Engr., says that among the improvements contemplated for 1902 are the extension of water mains, the construction of a settling basin at the pumping station, and an irrigation system for the park.

The question of issuing bonds for water works will be voted on at the following places: Lancaster, Tex., March 1; Eureka, Mont., March 4; Elkhart, Ind.; Carthage, Mo.; Virginia, Ill.; Cold Springs, Minn.; Deep River, Ia.; Swea City, Ia.; Truman, Minn.

The constuction of water works is contemplated at the following places: Oakland, Md.; Conrad, Ia.; Spring Lake, Mich.; Toulon, Ill.; White Lake, S. D.; Argyle, Minn.; Edinburg, N. D.; Huntsville, Mo.; Crawfordsville, Ia.; Whitehouse, O.; Pennsgrove, Pa.; Auburn, Mo.; Lehigh, Ia.; Hillsboro, O.; Bird Island, Minn.; Brookside, Ala.; Natchez, Miss.; Waynetown, Ind.; Deep River, Ia.; Eldridge, Ia.; Madrid, Ia.

CONTRACTS TO BE LET.

Elizabeth City, N. J.—Bids are asked until March 3 for installing a water works system. Bd. com'rs.

Columbus Grove, O.—Sealed bids are asked until March 21 for a water works system. Charles Killen, vil. clk.

Marshall, Mo.—Sealed bids are asked until March 3 for constructing a water works system. A. R. James, cy. engr.

Cambridge, Minn.—Sealed bids are asked until March 4 for building a water works system. P. M. Torell, recdr.

Mechanicsville, Ia.—Bids are asked until March 3 for a water works system. C. H. Meredith, engr., Cedar Rapids, Ia.

Fullerton, Neb.—Bids are asked until 8 p. m. March 4 for the removal of all machinery in the pumping station and the erection of a portion of the same machinery at a new location. C. F. Bake, cy. engr.

Lancaster, Ky.—The franchise for the water works will be sold March 29. Judge Joe Robinson, Capt. William Herndon, coms.

Batesville, Ind.—Bids are asked until March 24 for furnishing and laying 1¼ mis. 4 and 6-in. mains, including hydrants and valves. Town clerk.

Cincinnati, O.—Bids are asked until March 14 for furnishing c. i. pipe specials, etc., for the western pumping station. C. G. Roth, clk. comrs. w. w.

Chicago, Ill.—Sealed bids are asked until March 5 for constructing water service pipes in 7 streets. Bernard F. Rogers, pres. board of local improvements.

Cleveland, O.—Bids are asked until March 5 for furnishing fire hydrants, c. i. water pipe, special castings, water valves, etc. Charles P. Salen, dir. pub. wks.

Spokane, Wash.—Bids are asked by the Washington Water Power Company until March 15 for about 1,200 ft. of riveted steel pipe and two 66-ft. standpipes, 10 ft. in diameter.

Lewiston, Idaho—Bids are asked until March 24 for constructing the mains for the proposed water works system. Ernest McCullough, cy. engr., C. L. McDonald, cy. clk.

Boston, Mass.—Bids are asked until March 6 for furnishing and laying 4,730 feet of 7½-ft. pipe for the Western Aqueduct, building bridge abutments, etc. W. N. Davenport, secy. Met. water & sewerage bd.

CONTRACTS AWARDED.

Radford, Va.—A water works franchise has been granted the Radford Water Power Company.

Pleasantville, N. J.—A franchise for a water supply has been granted to the Pleasantville Water Company.

Bloomington, Ill.—The contract for laying a water main on E. Jefferson-st. was awarded to Robt. Loudon.

Albany, Minn.—The contract for a water works system was awarded to the Allan Black Company of St. Paul for $7,676.

Jamestown, N. D.—The contract for a steel tower and water tank at the asylum was awarded to the U. S. Wind Engine Company of Batavia, Ill., for $1,430.

Seattle, Wash.—The contract for a

water main in Eighth-ave., from James to Main, was awarded, Feb. 8, to Joe Frank for $3,047.50.

Detroit, Mich.—The contract for 513 water gates was awarded to the Co-Operative Foundry Company for 3,921½ tons of water pipe to the Detroit branch of American Car & Foundry Company at $25.50 per ton.

Columbus, O.—The contract for supplying this city with 10,000 water meters has been awarded to the Hersey Meter Company of Boston; Thompson Meter Company of New York; Pittsburg Meter Company of Pittsburg; Neptune Meter Company of New York. The manufacturers will furnish the meters to the city and the water works department will sell them to consumers at the following prices. Six thousand five-eighths meters at $7 each; 3,500 three-quarter inch meters at $10 each; 375 one-inch meters at $14 each. The larger size, of which only about 100 are needed, will be furnished at prices proportionate to the above.

BRIDGES.

Kearney, Neb.—Bids are asked until March 15 for two bridges. Co. clk.

Hartland, Wis.—The town board is in favor of building a bridge across the river.

Oneida, N. Y.—The board of public works has been requested by the common council to construct a bridge across the canal feeder at the west end of Furnace-ave.

Frankfort, Ind.—Sealed bids are asked until 2 p. m. March 10 for erecting a number of steel bridges on stone abutments. W. H. Arnemtrout, chmn. co. comrs.

Vincennes, Ind.—The county council voted to authorize the county commissioners to borrow $20,000 for iron bridges.

Bangor, Me.—The Bangor Bridge Company has submitted a proposition offering to sell the Bangor-Brewer bridge to the two cities for $60,000.

Charleston, Mo.—Bids are asked until March 4 for a bridge across White pond, on the Charleston & Wolfe Island road. C. S. Reynolds, road and bridge comr.

Ogden, Utah.—A. F. Parker will prepare plans and specifications for the construction of the West Weber-Plain City bridge.

Fowler, Ind.—Sealed bids are asked until March 4 for two steel bridges. David R. Calloway, prest. co. comrs.; Jas. D. Smyth, co. audt.

St. Thomas, Ont.—Bids are asked until March 17 for the erection of two steel bridges over the River Thames. James A. Bell, co. engr.

Mishawaka, Ind.—The citizens of River Park have circulated a petition for a bridge across the river in this city, west of the present structure.

Lansing, Mich.—The contract for building a Melan arch bridge on Washington-ave., south, was awarded to Stamsen & Biome of Chicago for $31,500.

Vicksburg, Miss.—Bids are asked until March 3 for a bridge over the Glass bayou. J. D. Laughlin, clk. co. court.

Cleveland, O.—Bids are asked until March 13 for the superstructure and substructure of the Seneca-st. bridge.

Bay City, Mich.—A resolution was adopted Feb. 10 providing for the preliminaries in condemnation proceedings of the land lying between the foot of Columbus-ave. and the Saginaw river, where the proposed bridge will be built.

Lafayette, Ind.—Sealed bids are asked until March 4 for repairing the superstructure and substructure of a bridge across the Wabash river at Brown-st. Geo. A. Jamison, co. audt.

Chicago, Ill.—Sealed bids are asked until March 6 for 21 riveted steel highway bridges over the Illinois & Mississippi canal. Major J. H. Willard, 1637 Indiana-ave.

Chicago, Ill.—Bids are asked until March 8 for constructing foundations for 2 locks and 4 arch culverts in and under the Illinois and Mississippi canal. J. H. Willard, major engrs.

Boston, Mass.—Bids are asked until March 6 for bridge abutments, etc., of bridge to support a pipe arch across the Sudbury river. W. N. Davenport, secy. met. water and sewerage bd.

Nebraska City, Neb.—(Special.)—A. M. Munn, cy. engr., says the contract for bridges to be constructed in Otoe county during the ensuing year was awarded to H. T. Ward & Co. of Tecumseh, Neb.

Chillicothe, Ill.—(Special.)—A movement has been started to build a bridge over the Illinois river at this point and throw up about 150,000 yards of dike approaching it through the bottoms. The bridge to be about 800 feet long, with draw in middle. Joseph Daily, Chillicothe, Ill., is the promoter.

Bozeman, Mont.—(Special.)—Bids will be received until 2 o'clock p. m. March 5, 1902, for the construction of a fifty-six-foot span steel or iron bridge across the East Gallatin river, 16-foot roadway and 16 feet in height, stone abutments, material for the same furnished on the ground by the county. Certified check for 10 per cent. of the amount of the bid required accompanying said bid. C. N. Blankenship, co. clk. and recorder.

STREET LIGHTING.

Rockford, Ill.—A municipal lighting plant is proposed.

Buffalo, N. Y.—The sliding scale in city lighting is proposed.

Blue Rapids, Kas.—An electric light franchise is proposed.

Albion, Mich.—The question of a municipal light plant will be voted on.

Wellington, Kas.—Bids will be received March 10 for an electric light plant.

Wyandotte, Mich.—The purchase of a new dynamo has been recommended. Mayor Campbell.

New Orleans, La.—Bids are asked until March 24 for a municipal electric light plant.

Oklahoma City, Ok. T.—A franchise has been granted the Oklahoma City Gas & Electric Power Company.

Dallas, Tex.—An electric light franchise has been granted C. H. Alexander and associates.

Indianapolis, Ind.—A twenty-five-year franchise has been granted the Marion County Hot Water Heating Company.

Canastota, N. Y.—A five-year franchise has been granted the Canastota Electric Light & Power Company.

Detroit, Mich.—The Detroit Arc Gas Light Company has been incorporated to manufacture and sell arc lamps.

Dale, Ind.—A franchise for an electric light plant has been granted to Charles Rudicil and J. F. Wallace.

Escanaba, Mich.—The question of selling or retaining the electric light and gas plant will be voted on in March.

Hillsdale, Mich.—The question of extending the electric light plant will be voted on in April. H. C. Blackman, mayor.

Marshall, Mo.—Sealed bids are asked until March 3 for an electric light plant. A. R. James, cy. clk.

Edwardsville, Ill.—Sealed bids are asked until March 31 for furnishing public, commercial and private electric lighting. Frank A. Daech, chm. com.

Racine, Wis.—The Wisconsin Heat and Light Company has been incorporated to build a modern heating plant to furnish heat to the residences, stores, factories, etc.

Hempstead, L. I., N. Y.—The matter of awarding a lighting contract to the Roslyn Light and Power Company will be voted on, according to press reports.

Cadillac, Mich.—The city council has granted a gas franchise to J. R. Bishop, E. F. Sawyer, R. W. Massey and W. J. Cornwell of this city and C. H. Cady of Ann Arbor.

Santa Rosa, Cal.—Bids are asked until March 8 for the purchase of a franchise of gas mains. The California Central Gas and Electric Company has applied for the franchise.

Bloomington, Ill.—The question of issuing bonds for the reconstruction of the municipal lighting plant will probably be submitted to vote.

Hartford City, Ind.—The proposition of the American Light and Water Company to purchase the electric lighting system of this city will be accepted.

Alexandria, Va.—The committee on light has reported in favor of installing a new and modern method of making coal gas at the city gas works.

The question of issuing bonds for electric light plants will be voted on at the following places: Seattle, Wash., Mar.; Cold Spring, Minn.

Electric light plants are contemplated at the following places: Somers' Point, N. J.; Mankato, Minn.; Montague, Mich.; Fayette, Ia.; Delavan, Minn.; Adel, Ga.; Albert Lea, Minn.; Argyle, Minn.

PARKS.

Goldfield, Ia.—The park will be improved.

Nashville, Tenn.—This city will probably vote on a system of parks.

Milwaukee, Wis.—A plan is being formulated for making Jones Island a park.

Pekin, Ill.—The establishment of a city park is contemplated. Mayor Conzelman.

Baker City, Ore.—(Special)—R. D. Carter, Mayor, says that a tax levy has been made for a city park.

Terre Haute, Ind.—A business man has offered to give $200 toward a public fund for a river front park.

Utica, N. Y.—The contract for the care of all the public parks in the city was awarded to John H. Campbell, for $1,600.80.

Chicago, Ill.—A resolution was adopted Feb. 11, urging the West Town Corporate officers to hasten the issue of the $1,000,000 small-park bonds.

Syracuse, N. Y.—F. W. Betts, C. G. Connette, George A. Glynn, Edward DeVine and Eugene Weiskotten have been appointed on a committee to urge the city council to purchase Kirk Park for a city park.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Butte, Mont.—Bids are asked until March 5 for a garbage incinerator.

Baltimore, Md.—Bids will be asked soon for removing the garbage.

Minneapolis, Minn.—Mayer Ames says this city should have three garbage crematories.

Martin's Ferry, O.—The question of building a garbage disposal plant is being considered.

Buffalo, N. Y.—The sum of $10,000 has been appropriated for cleaning the snow off the streets.

Joplin, Mo.—A committee was appointed Feb. 10 to purchase a new sprinkler. Cy. Engr. Seiles.

York, Pa.—An ordinance for the removal of organic garbage is being considered by the garbage committee.

Meriden, Conn.—The health committee has been directed to let a contract for collecting the garbage for three years.

Davenport, Ia.—Henry Nable, st. com'r., has been investigating street sprinklers, wheeled scrapers and street sweepers, according to press reports.

Baltimore, Md.—The contract for hauling the city garbage away from the dumps in scows until Oct. 5 was awarded Feb. 18 to Jas. D. Hughes for $4,750. Commissioner Iglehart hopes to have the new garbage collection contract in force by Oct. 5.

Indianapolis, Ind.—Bids were received Feb. 24 for sweeping and cleaning the streets as follows: Marion County Construction Company, entire city for one year, 17 cents per 10,000 square feet each sweeping; entire city for three years, 16 cents. J. H. Furnas—For one year, District 1, 17½ cents; District 2, 17½ cents; District 3, 17½ cents; district 4, 17½ cents; District 5, 17½ cents; all districts, 17½ cents. For three years, District 1, 17¼ cents; District 2, 17¼ cents; District 3, 17¼ cents; District 4, 17¼ cents; District 5, 17¼ cents; all districts, 17¼ cents. A. F. Shover—For one year, District 1, 22 cents; District 2, 22 cents; District 3, 23 cents; District 4, 23 cents; District 5, 23 cents; all districts, 23 cents. For three

years, District 1, 21 cents; District 2, 21 cents; District 3, 22 cents; District 4, 22 cents; District 5, 23 cents; all districts, 21½ cents. Stuckmeyer & Behrent—All districts for three years, 32¾ cents.

FIRE APPARATUS.

Rochester, N. Y.—New fire apparatus is needed.

Abilene, Kas.—A better fire alarm system is proposed. Mayor Halleck.

St. Hilaire, Minn.—The purchase of a fire engine will be voted on.

Andover, O.—The council will purchase a calliope fire alarm whistle.

Atlantic City, N. J.—A new fire station will be built at Arctic and Maryland-aves.

Rochester, Pa.—The purchase of a hook and ladder truck is contemplated.

Kalamazoo, Mich.—The purchase of a fire-fighting apparatus is proposed. Mayor Mills.

Nashville, Tenn.—A bill was passed Feb. 13 appropriating $2,000 for the purchase of hose. Mayor Head.

Mannington, W. Va.—The purchase of additional fire apparatus is contemplated.

Lorain, O.—The fire and water commissioners have been authorized to purchase 300 feet of fire hose.

Canandaigua, N. Y.—An appropriation of $500 for a new chemical fire engine has been asked for.

Toledo, O.—An ordinance was passed Feb. 17 providing for the issue of $36,000 bonds for the fire department.

Kewanee, Ill.—The purchase of a new fire alarm and a hose wagon equipped with extension ladders and fire net is proposed. Mayor Whiffen.

Janesville, Wis.—An order has been adopted for a fire alarm box at the corner of Cornelia and Glen-sts. Mayor Richardson.

Oshkosh, Wis.—The Seagrave Company of Columbus, O., was awarded the contract for a combination chemical engine and hose wagon for $1,600.

Waupun, Wis.—The chief of the fire department has notified the council that 500 feet of hose is needed.

Cripple Creek, Col.—The Gamewell Fire Alarm Telegraph Company was awarded the contract for a new fire alarm system for $1,590.

Old Town, Me.—Aldermen Phelps, Larcher and Lovejoy have been appointed a committee to ascertain the cost of suitable equipment for a horse hose cart.

Provo City, Utah.—An appropriation has been asked for to aid in the purchase of uniforms for the Provo Volunteer and Engine Company.

St. Paul, Minn.—The superintendent of fire alarms has been instructed to investigate the cost of installing a new fire bell at some point in this city.

Bradford, Pa.—(Special.)—The joint finance committee of councils will make an appropriation for the purchase of a fire engine. A. F. Bannon, cy. engr.

TOO LATE FOR CLASSIFICATION

Auburn, Ind.—Sealed bids are asked until March 20 for building 11 steel bridges and abutments. Frank P. Seiler, co. audt.

Dover, Del.—Surveys and plans for a sewerage system will be made by T. Chalkley Hatton of Wilmington.

Holland, Mich.—The question of extending the water works system and electric plants will be voted on.

Utica, N. Y.—Plans for the proposed viaduct conveying Genesee-st. over the tracks of the New York Central railroad have been submitted to Mayor Talcott.

Toledo, O.—The Norh Baltimore Stone Company was incorporated Feb. 20 to quarry stone, macadamize roads, etc., by A. W., L. A. and E. H. Eckert, Hiram C. Nicholas and W. M. Brown.

Richmond, Va.—The street department has asked for $1,049,968 for the needs of the city this year, including paving, grading, curbing, alleys, sidewalks, bridges, etc.

Seattle, Wash.—The contract for constructing the Tremont Valley water main was awarded Feb. 15 to C. J. Erickson of Seattle for $73,840.69. T. McLellen was awarded the contract for paving Jackson-st., from Second-ave. S. to Occidental-ave., with brick for $5,015.

Waukesha, Wis.—Timothy C. Ryan of this city was appointed receiver of the Waukesha Water Company Feb. 22 by Judge W. H. Seaman of the United States district court. The assets of the company are said to exceed the liabilities, and the creditors will be paid in full. Creditors of the company appeared in the court and asked for its adjudication as an involuntary bankrupt, and Judge Seaman signed an order to show cause, returnable in ten days, why the company should not be declared bankrupt.

Petaluma, Cal.—(Special.)—N. S. Frost, cy. engr., says that resolutions of intention have been passed for the construction of 650 lin. ft. of 6-inch pipe sewer on B-st.; 2,240 ft. of 8-inch sewer on G-st.; 1,950 ft. of 8-inch sewer in H-st.; 366 ft. of 8-inch and 1,059 ft. of 1-inch sewer in Third-st.; 516 ft. of 6-inch sewer in Sixth-st. Bids will be asked the later part of March or the first of April. Plank curbs and gravel sidewalks have been ordered on portions of eighteen streets in various parts of the city, the work to be done by property-owners by private contract. Liberty-st. is being graded and macadamized by Contractor Nesbet by private contract at 3¾ cents a sq. ft.

Taunton, Mass.—(Special.)—The street lighting for this year was awarded in two divisions. Michael O'Brien of this city secured the contract for lighting and care of the lamps at 2 cents per light per night, and the Pierce Hardware Company of this city was awarded the contract for furnishing the naptha at 12.4 cents per gallon. A special committee has been appointed, under the recommendation of Mayor Warner, to have charge of all matters relating to the needs of municipal electric light plant. The appointment of the committee is regarded as preliminary to the recommendation of an appropriation for the erection of a new plant to replace the one which the city was forced by law to acquire when it voted to own its electric plant.

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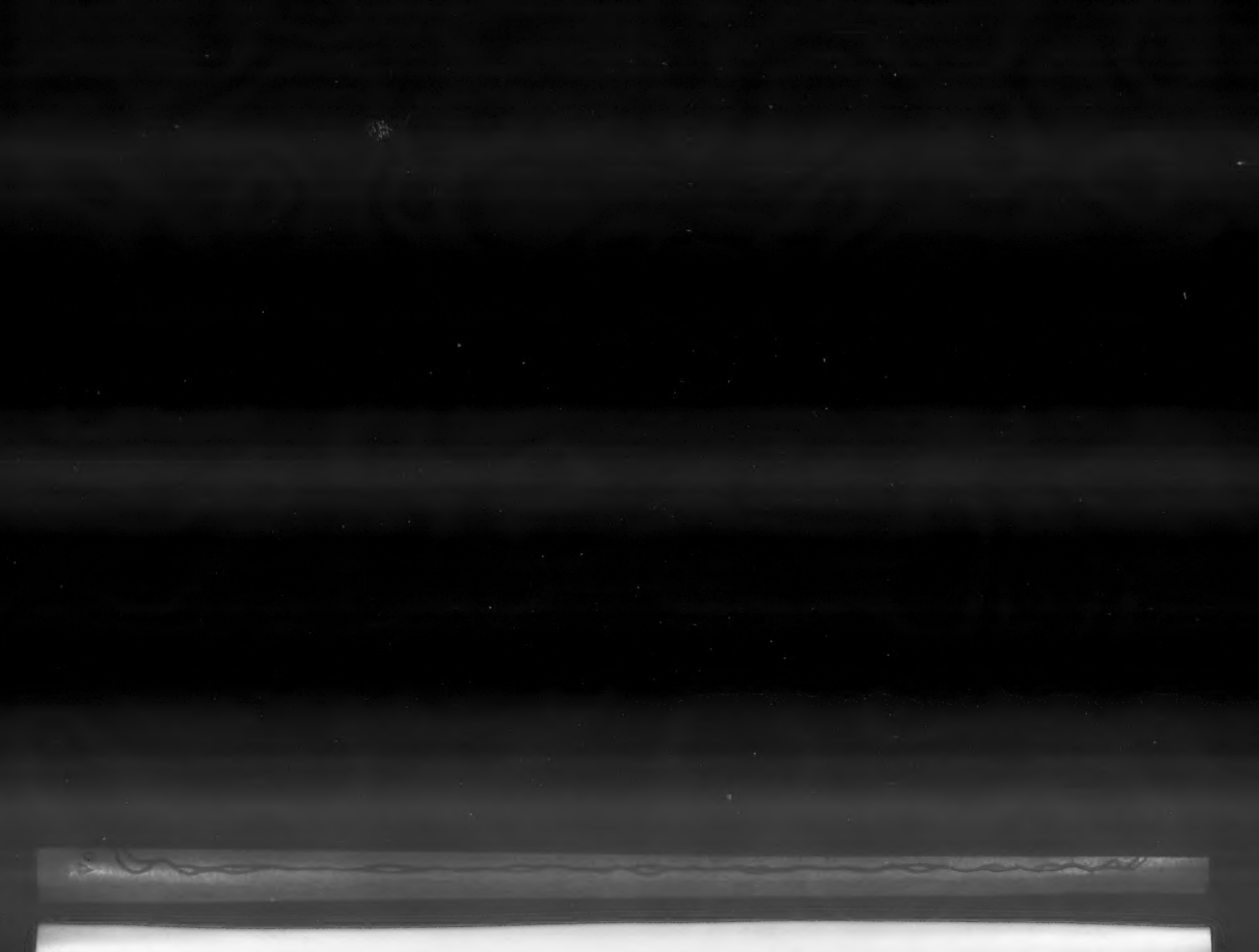
INDIANAPOLIS, IND.